Oracle VM VirtualBox

User Guide for Release 7.0

F43655-13
June 2024

Oracle VM VirtualBox User Guide for Release 7.0,

F43655-13

Copyright © 2022, 2024, Oracle and/or its affiliates.

Contents

Preface

Audience xvi
Related Documents xvi
Conventions xvi
Documentation Accessibility xvi
Access to Oracle Support for Accessibility xvi
Diversity and Inclusion xvi

1 First Steps

Why is Virtualization Useful? 1-2
Some Terminology 1-2
Features Overview 1-3
Supported Host Operating Systems 1-5
- Host CPU Requirements 1-6

Installing Oracle VM VirtualBox and Extension Packs 1-6
Starting Oracle VM VirtualBox 1-7
VirtualBox Manager 1-7
- The Machine List 1-9
- The Details Pane 1-9
  - VirtualBox Manager Toolbar 1-9
  - Settings 1-10
  - Preview Window 1-10
  - Notification Center 1-10
- VirtualBox Manager Tools 1-10
  - Global Tools 1-11
  - Machine Tools 1-12
- Help Viewer 1-12
- About VirtualBox Manager Wizards 1-13

Creating Your First Virtual Machine 1-13
- Create Virtual Machine Wizard: Name and Operating System 1-14
- (Optional) Create Virtual Machine Wizard: Unattended Guest OS Install 1-15
- Create Virtual Machine Wizard: Hardware 1-16
- Create Virtual Machine Wizard: Virtual Hard Disk 1-17

Create Virtual Machine Wizard: Summary 1-19
Some Examples of Unattended Installation 1-19
Running Your Virtual Machine 1-19
Starting a New VM for the First Time 1-20
Virtual Machine Status Bar 1-20
Capturing and Releasing Keyboard and Mouse 1-23
Typing Special Characters 1-24
Changing Removable Media 1-25
Resizing the Machine's Window 1-25
Saving the State of the Machine 1-26
Using VM Groups 1-27
Snapshots 1-28
Taking, Restoring, and Deleting Snapshots 1-29
Snapshot Contents 1-31
Virtual Machine Configuration 1-31
Removing and Moving Virtual Machines 1-32
Cloning Virtual Machines 1-32
Importing and Exporting Virtual Machines 1-35
About the OVF Format 1-35
Importing an Appliance in OVF Format 1-36
Exporting an Appliance in OVF Format 1-37
Integrating with Oracle Cloud Infrastructure 1-37
Preparing for Oracle Cloud Infrastructure Integration 1-38
Creating an API Signing Key Pair 1-38
Uploading the Public Key to Oracle Cloud Infrastructure 1-39
Creating a Cloud Profile 1-40
Using the Cloud Profile Manager 1-40
Using Oracle VM VirtualBox With Oracle Cloud Infrastructure 1-42
Using Cloud Virtual Machines 1-43
About the OCI VM Group 1-44
Creating a New Cloud VM 1-44
Adding a Cloud VM 1-45
Changing Settings for a Cloud VM 1-46
Controlling a Cloud VM 1-46
Removing a Cloud VM 1-47
Creating an Instance Console Connection for a Cloud VM 1-47
Exporting an Appliance to Oracle Cloud Infrastructure 1-47
Preparing a VM for Export to Oracle Cloud Infrastructure 1-49
Importing an Instance from Oracle Cloud Infrastructure 1-50
Importing an Instance: Overview of Events 1-51
Using a Cloud Network 1-51
Using VBoxManage Commands With Oracle Cloud Infrastructure 1-52

Preferences 1-53
Alternative Front-Ends 1-54
Soft Keyboard 1-54
Using the Soft Keyboard 1-55
Creating a Custom Keyboard Layout 1-56
Monitoring of Virtual Machines 1-56
VM Activity Overview 1-57
Session Information Dialog 1-57
The Log Viewer 1-58

2 Installation Details

Installing on Windows Hosts 2-1
Prerequisites 2-1
Windows Installation Directory Security Requirements 2-1
Performing the Installation 2-2
Uninstallation 2-3
Unattended Installation 2-3
Public Properties 2-4
Installing on macOS Hosts 2-4
Performing the Installation 2-4
Uninstallation 2-4
Unattended Installation 2-5
Installing on Linux Hosts 2-5
Prerequisites 2-5
The Oracle VM VirtualBox Kernel Modules 2-5
Kernel Modules and UEFI Secure Boot 2-6
Performing the Installation 2-7
Installing Oracle VM VirtualBox from a Debian or Ubuntu Package 2-7
Using the Alternative Generic Installer (VirtualBox.run) 2-7
Performing a Manual Installation 2-8
Updating and Uninstalling Oracle VM VirtualBox 2-9
Automatic Installation of Debian Packages 2-9
Automatic Installation of RPM Packages 2-10
Automatic Installation Options 2-10
The vboxusers Group 2-10
Starting Oracle VM VirtualBox on Linux 2-10
Installing on Oracle Solaris Hosts 2-11
Performing the Installation 2-11
The vboxuser Group 2-11
Starting Oracle VM VirtualBox on Oracle Solaris 2-12
Uninstallation 2-12

Unattended Installation 2-12
Configuring a Non-Global Zone for Running Oracle VM VirtualBox 2-12
Installing an Extension Pack 2-13
The Extension Pack Manager 2-13

3 Configuring Virtual Machines

Supported Guest Operating Systems 3-1
Mac OS X Guests 3-2
64-bit Guests 3-3
Unattended Guest Installation 3-3
Using VBoxManage Commands for Unattended Guest Installation 3-4
Emulated Hardware 3-5
General Settings 3-6
Basic Tab 3-6
Advanced Tab 3-6
Description Tab 3-7
Disk Encryption Tab 3-7
System Settings 3-7
Motherboard Tab 3-8
Processor Tab 3-9
Acceleration Tab 3-10
Display Settings 3-10
Screen Tab 3-10
Remote Display Tab 3-11
Recording Tab 3-12
Storage Settings 3-12
Audio Settings 3-14
Network Settings 3-15
Serial Ports 3-15
USB Support 3-17
USB Settings 3-17
Implementation Notes for Windows and Linux Hosts 3-18
Shared Folders 3-18
User Interface 3-19
Alternative Firmware (EFI) 3-19
Video Modes in EFI 3-19
Specifying Boot Arguments 3-21

4 Guest Additions

Introduction to Guest Additions 4-1

Installing and Maintaining Guest Additions 4-2
Guest Additions for Windows 4-2
Installing the Windows Guest Additions 4-3
Updating the Windows Guest Additions 4-4
Unattended Installation of the Windows Guest Additions 4-4
Manual File Extraction 4-6
Guest Additions for Linux 4-6
Installing the Linux Guest Additions 4-6
Unattended Installation of the Linux Guest Additions 4-7
Graphics and Mouse Integration 4-7
Updating the Linux Guest Additions 4-8
Uninstalling the Linux Guest Additions 4-8
Guest Additions for Oracle Solaris 4-9
Installing the Oracle Solaris Guest Additions 4-9
Unattended Installation of the Oracle Solaris Guest Additions 4-9
Uninstalling the Oracle Solaris Guest Additions 4-9
Updating the Oracle Solaris Guest Additions 4-9
Guest Additions for OS/2 4-10
Shared Folders 4-10
Manual Mounting 4-11
Automatic Mounting 4-12
Drag and Drop 4-13
Supported Formats 4-14
Known Limitations 4-15
Hardware-Accelerated Graphics 4-15
Hardware 3D Acceleration (OpenGL and Direct3D 8/9) 4-15
Hardware 2D Video Acceleration for Windows Guests 4-16
Seamless Windows 4-17
Guest Properties 4-18
Using Guest Properties to Wait on VM Events 4-20
Guest Control File Manager 4-20
Using the Guest Control File Manager 4-21
Guest Control of Applications 4-21
Memory Overcommitment 4-21
Memory Ballooning 4-22
Page Fusion 4-23
Controlling Virtual Monitor Topology 4-24
X11/Wayland Desktop Environments 4-24
Known Limitations 4-24

5 Virtual Storage

Hard Disk Controllers 5-1
Disk Image Files (VDI, VMDK, VHD, HDD) 5-4
The Virtual Media Manager 5-5
- Creating a Virtual Hard Disk Image 5-8
- Creating a Virtual Optical Disk Image 5-9
- Creating a Virtual Floppy Disk Image 5-9

Special Image Write Modes 5-9
Differencing Images 5-12
Cloning Disk Images 5-13
Host Input/Output Caching 5-14
Limiting Bandwidth for Disk Images 5-15
CD/DVD Support 5-15
iSCSI Servers 5-16
vboximg-mount: A Utility for FUSE Mounting a Virtual Disk Image 5-16
- Viewing Detailed Information About a Virtual Disk Image 5-17
- Mounting a Virtual Disk Image 5-18

6 Virtual Networking

Virtual Networking Hardware 6-1
Introduction to Networking Modes 6-2
Network Address Translation (NAT) 6-3
- Configuring Port Forwarding with NAT 6-4
- PXE Booting with NAT 6-5
- NAT Limitations 6-5

Network Address Translation Service 6-5
Bridged Networking 6-7
Internal Networking 6-8
Host-Only Networking 6-9
UDP Tunnel Networking 6-10
VDE Networking 6-11
Cloud Networks 6-12
Network Manager 6-12
- Host-Only Networks Tab 6-13
- NAT Networks Tab 6-13
- Cloud Networks Tab 6-13

Limiting Bandwidth for Network Input/Output 6-14
Improving Network Performance 6-14

7 Remote Virtual Machines

Remote Display (VRDP Support) 7-1
- Common Third-Party RDP Viewers 7-2
- VBoxHeadless, the Remote Desktop Server 7-3
- Step by Step: Creating a Virtual Machine on a Headless Server 7-4
- Remote USB 7-5
- RDP Authentication 7-5
- RDP Encryption 7-7
- Multiple Connections to the VRDP Server 7-8
- Multiple Remote Monitors 7-8
- VRDP Video Redirection 7-8
- VRDP Customization 7-9

Teleporting 7-9
VBoxHeadless 7-10

8 VBoxManage

Introduction 8-1
Commands Overview 8-2
General Options 8-31
VBoxManage 8-31
VBoxManage adoptstate 8-33
VBoxManage bandwidthctl 8-34
VBoxManage checkmediumpwd 8-37
VBoxManage clonemedium 8-38
VBoxManage clonevm 8-40
VBoxManage closemedium 8-42
VBoxManage cloud 8-43
VBoxManage cloudprofile 8-51
VBoxManage controlvm 8-54
VBoxManage convertfromraw 8-78
VBoxManage createmedium 8-80
VBoxManage createvm 8-82
VBoxManage debugvm 8-84
VBoxManage dhcpserver 8-92
VBoxManage discardstate 8-103
VBoxManage encryptmedium 8-104
VBoxManage encryptvm 8-106
VBoxManage export 8-108
VBoxManage extpack 8-112
VBoxManage getextradata 8-114

VBoxManage guestcontrol 8-115
VBoxManage guestproperty 8-129
VBoxManage hostonlyif 8-132
VBoxManage hostonlynet 8-134
VBoxManage import 8-136
VBoxManage list 8-140
VBoxManage mediumio 8-147
VBoxManage mediumproperty 8-149
VBoxManage metrics 8-151
VBoxManage modifymedium 8-155
VBoxManage modifynvram 8-157
VBoxManage modifyvm 8-161
VBoxManage movevm 8-184
VBoxManage natnetwork 8-185
VBoxManage registervm 8-189
VBoxManage setextradata 8-190
VBoxManage setproperty 8-190
VBoxManage sharedfolder 8-192
VBoxManage showmediuminfo 8-194
VBoxManage showvminfo 8-195
VBoxManage signova 8-197
VBoxManage snapshot 8-199
VBoxManage startvm 8-203
VBoxManage storageattach 8-204
VBoxManage storagectl 8-209
VBoxManage unattended 8-210
VBoxManage unregistervm 8-213
VBoxManage updatecheck 8-214
VBoxManage usbdevsource 8-216
VBoxManage usbfilter 8-217
vboximg-mount 8-220

9 Advanced Topics

Automated Guest Logins 9-1
Automated Windows Guest Logins 9-1
Automated Linux and UNIX Guest Logins 9-2
Oracle VM VirtualBox Greeter for Ubuntu/LightDM 9-4
Advanced Configuration for Windows Guests 9-6
Automated Windows System Preparation 9-6
Advanced Configuration for Linux and Oracle Solaris Guests 9-6
Manual Setup of Selected Guest Services on Linux 9-6

Guest Graphics and Mouse Driver Setup in Depth 9-7
CPU Hot-Plugging 9-8
Webcam Passthrough 9-9
Using a Host Webcam in the Guest 9-9
Windows Hosts 9-10
macOS Hosts 9-10
Linux and Oracle Solaris Hosts 9-10
Advanced Display Configuration 9-10
Custom VESA Resolutions 9-10
Configuring the Maximum Resolution of Guests When Using the Graphical Frontend 9-11
Advanced Storage Configuration 9-11
Using a Raw Host Hard Disk From a Guest 9-11
Access to Entire Physical Hard Disk 9-12
Access to Individual Physical Hard Disk Partitions 9-12
Configuring the Hard Disk Vendor Product Data (VPD) 9-13
Access iSCSI Targets Using Internal Networking 9-14
Fine Tuning the Oracle VM VirtualBox NAT Engine 9-15
Configuring the Address of a NAT Network Interface 9-15
Configuring the Boot Server (Next Server) of a NAT Network Interface 9-15
Tuning TCP/IP Buffers for NAT 9-15
Binding NAT Sockets to a Specific Interface 9-16
Enabling DNS Proxy in NAT Mode 9-16
Using the Host's Resolver as a DNS Proxy in NAT Mode 9-16
User-Defined Host Name Resolving 9-16
Configuring Aliasing of the NAT Engine 9-17
Configuring the BIOS DMI Information 9-17
Configuring Custom ACPI Tables 9-19
Fine Tuning Timers and Time Synchronization 9-19
Configuring the Guest Time Stamp Counter (TSC) to Reflect Guest Execution 9-19
Accelerate or Slow Down the Guest Clock 9-20
Tuning the Guest Additions Time Synchronization Parameters 9-20
Disabling the Guest Additions Time Synchronization 9-21
Installing the Alternate Bridged Networking Driver on Oracle Solaris 11 Hosts 9-21
Oracle VM VirtualBox VNIC Templates for VLANs on Oracle Solaris 11 Hosts 9-22
Configuring Multiple Host-Only Network Interfaces on Oracle Solaris Hosts 9-22
Configuring the Oracle VM VirtualBox CoreDumper on Oracle Solaris Hosts 9-23
Oracle VM VirtualBox and Oracle Solaris Kernel Zones 9-24
Locking Down VirtualBox Manager 9-24
Customizing VirtualBox Manager 9-24
VM Selector Customization 9-25
Configure VM Selector Menu Entries 9-25
Configure VM Window Menu Entries 9-26

Configure VM Window Status Bar Entries 9-31
Configure VM Window Visual Modes 9-32
Host Key Customization 9-33
Action when Terminating the VM 9-34
Default Action when Terminating the VM 9-34
Action for Handling a Guru Meditation 9-35
Configuring Automatic Mouse Capturing 9-35
Requesting Legacy Full-Screen Mode 9-36
Removing Certain Modes of Networking From the GUI 9-36
Starting the Oracle VM VirtualBox Web Service Automatically 9-37
Linux: Starting the Web Service With init 9-37
Oracle Solaris: Starting the Web Service With SMF 9-38
macOS: Starting the Web Service With launchd 9-38
Oracle VM VirtualBox Watchdog 9-39
Memory Ballooning Control 9-39
Host Isolation Detection 9-40
More Information 9-41
Linux: Starting the Watchdog Service With init 9-41
Oracle Solaris: Starting the Watchdog Service With SMF 9-42
Other Extension Packs 9-42
Starting Virtual Machines During System Boot 9-43
Linux: Starting the Autostart Service With init 9-43
Oracle Solaris: Starting the Autostart Service With SMF 9-43
macOS: Starting the Autostart Service With launchd 9-44
Windows: Starting the Autostart Service 9-44
Encryption of VMs 9-45
Limitations of VM Encryption 9-46
Encrypting a VM 9-46
Opening the Encrypted VM 9-46
Decrypting Encrypted VMs 9-47
Oracle VM VirtualBox Expert Storage Management 9-47
Handling of Host Power Management Events 9-47
Passing Through SSE4.1/SSE4.2 Instructions 9-48
Support for Keyboard Indicator Synchronization 9-48
Capturing USB Traffic for Selected Devices 9-48
Configuring the Heartbeat Service 9-49
Encryption of Disk Images 9-49
Limitations of Disk Encryption 9-49
Encrypting Disk Images 9-50
Starting a VM with Encrypted Images 9-50
Decrypting Encrypted Images 9-51
Paravirtualized Debugging 9-51

Hyper-V Debug Options 9-51
Setting up Windows Guests for Debugging with the Hyper-V Paravirtualization Provider 9-52
PC Speaker Passthrough 9-54
Accessing USB devices Exposed Over the Network with USB/IP 9-55
Setting up USB/IP Support on a Linux System 9-56
Security Considerations 9-56
Using Hyper-V with Oracle VM VirtualBox 9-57
Nested Virtualization 9-57
VBoxSVC running in Windows Session 0 9-57
Known Issues 9-58
VISO file format / RTIsoMaker 9-58

10 Technical Background

Where Oracle VM VirtualBox Stores its Files 10-1
The Machine Folder 10-1
Global Settings 10-2
Summary of Configuration Data Locations 10-2
Oracle VM VirtualBox XML Files 10-2
Oracle VM VirtualBox Executables and Components 10-3
Hardware Virtualization 10-5
Details About Hardware Virtualization 10-6
Paravirtualization Providers 10-7
Nested Paging and VPIDs 10-7

11 Oracle VM VirtualBox Programming Interfaces

12 Troubleshooting

Procedures and Tools 12-1
Categorizing and Isolating Problems 12-1
Collecting Debugging Information 12-2
Using the VBoxBugReport Command to Collect Debug Information Automatically 12-2
The Built-In VM Debugger 12-3
VM Core Format 12-5
General Troubleshooting 12-6
Guest Shows IDE/SATA Errors for File-Based Images on Slow Host File System 12-6
Responding to Guest IDE/SATA Flush Requests 12-7
Performance Variation with Frequency Boosting 12-7
Frequency Scaling Effect on CPU Usage 12-8

Inaccurate Windows CPU Usage Reporting 12-8
Poor Performance Caused by Host Power Management 12-8
GUI: 2D Video Acceleration Option is Grayed Out 12-8
Windows Guests 12-9
No USB 3.0 Support in Windows 7 Guests 12-9
Windows Bluescreens After Changing VM Configuration 12-9
Windows 0x101 Bluescreens with SMP Enabled (IPI Timeout) 12-9
Windows 2000 Installation Failures 12-9
How to Record Bluescreen Information from Windows Guests 12-10
No Networking in Windows Vista Guests 12-10
Windows Guests may Cause a High CPU Load 12-10
Long Delays When Accessing Shared Folders 12-10
USB Tablet Coordinates Wrong in Windows 98 Guests 12-11
Windows Guests are Removed From an Active Directory Domain After Restoring a Snapshot 12-11
Windows 3.x Limited to 64 MB RAM 12-11
Linux and X11 Guests 12-11
Linux Guests May Cause a High CPU load 12-11
Buggy Linux 2.6 Kernel Versions 12-12
Shared Clipboard, Auto-Resizing, and Seamless Desktop in X11 Guests 12-12
Oracle Solaris Guests 12-12
Certain Oracle Solaris 10 Releases May Take a Long Time to Boot with SMP 12-12
Older Solaris Releases Do Not Work with E1000 Ethernet 12-13
Windows Hosts 12-13
Drag'n Drop not Working 12-13
VBoxSVC Out-of-Process COM Server Issues 12-13
CD and DVD Changes Not Recognized 12-14
Sluggish Response When Using Microsoft RDP Client 12-14
Running an iSCSI Initiator and Target on a Single System 12-14
Bridged Networking Adapters Missing 12-15
Host-Only Networking Adapters Cannot be Created 12-15
Linux Hosts 12-15
Linux Kernel Module Refuses to Load 12-15
Linux Host CD/DVD or Floppy Disk Drive Not Found 12-15
Strange Guest IDE Error Messages When Writing to CD or DVD 12-16
VBoxSVC IPC Issues 12-16
USB Not Working 12-16
PAX/grsec Kernels 12-17
Linux Kernel vmalloc Pool Exhausted 12-17
Oracle Solaris Hosts 12-17
Cannot Start VM, Not Enough Contiguous Memory 12-17

13 Security Guide

General Security Principles 13-1
Secure Installation and Configuration 13-1
- Installation Overview 13-1
- Post Installation Configuration 13-2

Security Features 13-2
- The Security Model 13-2
- Secure Configuration of Virtual Machines 13-2
  - Networking 13-2
  - VRDP Remote Desktop Authentication 13-3
  - Clipboard 13-3
  - Shared Folders 13-3
  - 3D Graphics Acceleration 13-3
  - CD/DVD Passthrough 13-3
  - USB Passthrough 13-3
- Configuring and Using Authentication 13-3
- Potentially Insecure Operations 13-4
- Encryption 13-4

Security Recommendations 13-5
- CVE-2018-3646 13-5
  - Disable Nested Paging 13-5
  - Flushing the Level 1 Data Cache 13-5
- CVE-2018-12126, CVE-2018-12127, CVE-2018-12130, CVE-2019-11091 13-6
  - Buffer Overwriting and Disabling Hyper-Threading 13-6

14 Known Limitations

Experimental Features 14-1
Known Issues 14-1

15 Oracle VM VirtualBox Privacy Information

16 Glossary

Preface

This document provides information on the advanced features of Oracle VM VirtualBox.

Audience

This document is intended for administrators with previous experience of using Oracle VM VirtualBox. It is assumed that readers are familiar with Web technologies and have a general understanding of Windows and UNIX platforms.

Related Documents

The documentation for this product is available at:

https://docs.oracle.com/en/virtualization/virtualbox/index.html

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
italic	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
`monospace`	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website.

Access to Oracle Support for Accessibility

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit https://www.oracle.com/corporate/accessibility/learning-support.html#support-tab.

Diversity and Inclusion

Oracle is fully committed to diversity and inclusion. Oracle respects and values having a diverse workforce that increases thought leadership and innovation. As part of our initiative to

build a more inclusive culture that positively impacts our employees, customers, and partners, we are working to remove insensitive terms from our products and documentation. We are also mindful of the necessity to maintain compatibility with our customers' existing technologies and the need to ensure continuity of service as Oracle's offerings and industry standards evolve. Because of these technical constraints, our effort to remove insensitive terms is ongoing and will take time and external cooperation.

1

First Steps

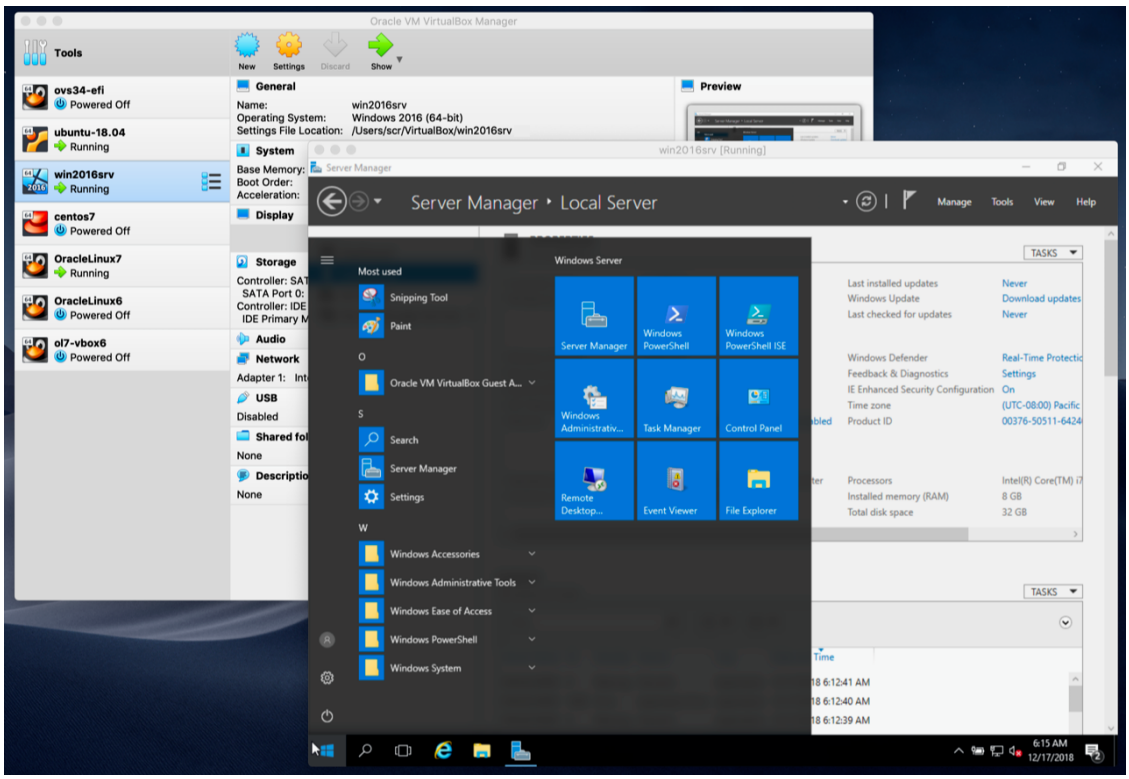
Welcome to Oracle VM VirtualBox.

Oracle VM VirtualBox is a cross-platform virtualization application. What does that mean? For one thing, it installs on your existing Intel or AMD-based computers, whether they are running Windows, macOS, Linux, or Oracle Solaris operating systems (OSes). Secondly, it extends the capabilities of your existing computer so that it can run multiple OSes, inside multiple virtual machines, at the same time. As an example, you can run Windows and Linux on your Mac, run Windows Server on your Linux server, run Linux on your Windows PC, and so on, all alongside your existing applications. You can install and run as many virtual machines as you like. The only practical limits are disk space and memory.

Oracle VM VirtualBox is deceptively simple yet also very powerful. It can run everywhere from small embedded systems or desktop class machines all the way up to datacenter deployments and even Cloud environments.

The following screenshot shows how Oracle VM VirtualBox, installed on an Apple Mac computer, is running Windows Server 2016 in a virtual machine window.

Figure 1-1 Windows Server 2016 Virtual Machine, Displayed on a macOS Host



In this User Manual, we will begin simply with a quick introduction to virtualization and how to get your first virtual machine running with the easy-to-use Oracle VM VirtualBox graphical user interface. Subsequent chapters will go into much more detail covering more powerful tools and

features, but fortunately, it is not necessary to read the entire User Manual before you can use Oracle VM VirtualBox.

You can find a summary of Oracle VM VirtualBox's capabilities in Features Overview. For existing Oracle VM VirtualBox users who just want to find out what is new in this release, see the Change Log.

Why is Virtualization Useful?

The techniques and features that Oracle VM VirtualBox provides are useful in the following scenarios:

- **Running multiple operating systems simultaneously.**Oracle VM VirtualBox enables you to run more than one OS at a time. This way, you can run software written for one OS on another, such as Windows software on Linux or a Mac, without having to reboot to use it. Since you can configure what kinds of *virtual* hardware should be presented to each such OS, you can install an old OS such as DOS or OS/2 even if your real computer's hardware is no longer supported by that OS.
- **Easier software installations.** Software vendors can use virtual machines to ship entire software configurations. For example, installing a complete mail server solution on a real machine can be a tedious task. With Oracle VM VirtualBox, such a complex setup, often called an *appliance*, can be packed into a virtual machine. Installing and running a mail server becomes as easy as importing such an appliance into Oracle VM VirtualBox.
- **Testing and disaster recovery.** Once installed, a virtual machine and its virtual hard disks can be considered a *container* that can be arbitrarily frozen, woken up, copied, backed up, and transported between hosts.

  Using virtual machines enables you to build and test a multi-node networked service, for example. Issues with networking, operating system, and software configuration can be investigated easily.

  In addition to that, with the use of another Oracle VM VirtualBox feature called *snapshots*, one can save a particular state of a virtual machine and revert back to that state, if necessary. This way, one can freely experiment with a computing environment. If something goes wrong, such as problems after installing software or infecting the guest with a virus, you can easily switch back to a previous snapshot and avoid the need of frequent backups and restores.

  Any number of snapshots can be created, allowing you to travel back and forward in virtual machine time. You can delete snapshots while a VM is running to reclaim disk space.
- **Infrastructure consolidation.** Virtualization can significantly reduce hardware and electricity costs. Most of the time, computers today only use a fraction of their potential power and run with low average system loads. A lot of hardware resources as well as electricity is thereby wasted. So, instead of running many such physical computers that are only partially used, one can pack many virtual machines onto a few powerful hosts and balance the loads between them.

Some Terminology

When dealing with virtualization, and also for understanding the following chapters of this documentation, it helps to acquaint oneself with a bit of crucial terminology, especially the following terms:

- **Host operating system (host OS).** This is the OS of the physical computer on which Oracle VM VirtualBox was installed. There are versions of Oracle VM VirtualBox for

Windows, macOS, Linux, and Oracle Solaris hosts. See Supported Host Operating Systems.

Most of the time, this manual discusses all Oracle VM VirtualBox versions together. There may be platform-specific differences which we will point out where appropriate.

- **Guest operating system (guest OS).** This is the OS that is running inside the virtual machine. Theoretically, Oracle VM VirtualBox can run any x86 OS such as DOS, Windows, OS/2, FreeBSD, and OpenBSD. But to achieve near-native performance of the guest code on your machine, we had to go through a lot of optimizations that are specific to certain OSes. So while your favorite OS *may* run as a guest, we officially support and optimize for a select few, which include the most common OSes.

  See Supported Guest Operating Systems.

- **Virtual machine (VM).** This is the special environment that Oracle VM VirtualBox creates for your guest OS while it is running. In other words, you run your guest OS *in* a VM. Normally, a VM is shown as a window on your computer's desktop. Depending on which of the various frontends of Oracle VM VirtualBox you use, the VM might be shown in full screen mode or remotely on another computer.

  Internally, Oracle VM VirtualBox treats a VM as a set of parameters that specify its behavior. Some parameters describe hardware settings, such as the amount of memory and number of CPUs assigned. Other parameters describe the state information, such as whether the VM is running or saved.

  You can view these VM settings in VirtualBox Manager, in the **Settings** window, and by running the `VBoxManage` command. See VBoxManage.

- **Guest Additions.** This refers to special software packages which are shipped with Oracle VM VirtualBox but designed to be installed *inside* a VM to improve performance of the guest OS and to add extra features. See Guest Additions.

Features Overview

The following is a brief outline of Oracle VM VirtualBox's main features:

- **Portability.**Oracle VM VirtualBox runs on a large number of 64-bit host operating systems. See Supported Host Operating Systems.

  Oracle VM VirtualBox is a so-called *hosted* hypervisor, sometimes referred to as a *type 2* hypervisor. Whereas a *bare-metal* or *type 1* hypervisor runs directly on the hardware, Oracle VM VirtualBox requires an existing OS to be installed. It can thus run alongside existing applications on that host.

  To a very large degree, Oracle VM VirtualBox is functionally identical on all of the host platforms, and the same file and image formats are used. This enables you to run virtual machines created on one host on another host with a different host OS. For example, you can create a virtual machine on Windows and then run it on Linux.

  In addition, virtual machines can easily be imported and exported using the Open Virtualization Format (OVF), an industry standard created for this purpose. You can even import OVFs that were created with a different virtualization software. See Importing and Exporting Virtual Machines.

  For users of Oracle Cloud Infrastructure the functionality extends to exporting and importing virtual machines to and from the cloud. This simplifies development of applications and deployment to the production environment. See Exporting an Appliance to Oracle Cloud Infrastructure.

- **Guest Additions: shared folders, seamless windows, 3D virtualization.** The Oracle VM VirtualBox Guest Additions are software packages which can be installed *inside* of

supported guest systems to improve their performance and to provide additional integration and communication with the host system. After installing the Guest Additions, a virtual machine will support automatic adjustment of video resolutions, seamless windows, accelerated 3D graphics and more. See Guest Additions.

In particular, Guest Additions provide for *shared folders*, which let you access files on the host system from within a guest machine. See Shared Folders.

- **Comprehensive hardware support.** Among other features, Oracle VM VirtualBox supports the following:
  - **Guest multiprocessing (SMP).**Oracle VM VirtualBox can present up to 32 virtual CPUs to each virtual machine, irrespective of how many CPU cores are physically present on your host.
  - **USB device support.**Oracle VM VirtualBox implements a virtual USB controller and enables you to connect arbitrary USB devices to your virtual machines without having to install device-specific drivers on the host. USB support is not limited to certain device categories. See USB Settings.
  - **Hardware compatibility.**Oracle VM VirtualBox virtualizes a vast array of virtual devices, among them many devices that are typically provided by other virtualization platforms. That includes IDE, SCSI, and SATA hard disk controllers, several virtual network cards and sound cards, virtual serial ports and an Input/Output Advanced Programmable Interrupt Controller (I/O APIC), which is found in many computer systems. This enables easy cloning of disk images from real machines and importing of third-party virtual machines into Oracle VM VirtualBox.
  - **Full ACPI support.** The Advanced Configuration and Power Interface (ACPI) is fully supported by Oracle VM VirtualBox. This enables easy cloning of disk images from real machines or third-party virtual machines into Oracle VM VirtualBox. With its unique *ACPI power status support*, Oracle VM VirtualBox can even report to ACPI-aware guest OSes the power status of the host. For mobile systems running on battery, the guest can thus enable energy saving and notify the user of the remaining power, for example in full screen modes.
  - **Multiscreen resolutions.**Oracle VM VirtualBox virtual machines support screen resolutions many times that of a physical screen, allowing them to be spread over a large number of screens attached to the host system.
  - **Built-in iSCSI support.** This unique feature enables you to connect a virtual machine directly to an iSCSI storage server without going through the host system. The VM accesses the iSCSI target directly without the extra overhead that is required for virtualizing hard disks in container files. See iSCSI Servers.
  - **PXE Network boot.** The integrated virtual network cards of Oracle VM VirtualBox fully support remote booting using the Preboot Execution Environment (PXE).
- **Multigeneration branched snapshots.**Oracle VM VirtualBox can save arbitrary snapshots of the state of the virtual machine. You can go back in time and revert the virtual machine to any such snapshot and start an alternative VM configuration from there, effectively creating a whole snapshot tree. See Snapshots. You can create and delete snapshots while the virtual machine is running.
- **VM groups.**Oracle VM VirtualBox provides a groups feature that enables the user to organize and control virtual machines collectively, as well as individually. In addition to basic groups, it is also possible for any VM to be in more than one group, and for groups to be nested in a hierarchy. This means you can have groups of groups. In general, the operations that can be performed on groups are the same as those that can be applied to individual VMs: Start, Pause, Reset, Close (Save state, Send Shutdown, Poweroff), Discard Saved State, Show in File System, Sort.

- **Clean architecture and unprecedented modularity.**Oracle VM VirtualBox has an extremely modular design with well-defined internal programming interfaces and a clean separation of client and server code. This makes it easy to control it from several interfaces at once. For example, you can start a VM simply by clicking on a button in the Oracle VM VirtualBox graphical user interface and then control that machine from the command line, or even remotely. See Alternative Front-Ends.

  Due to its modular architecture, Oracle VM VirtualBox can also expose its full functionality and configurability through a comprehensive **software development kit (SDK),** which enables integration of Oracle VM VirtualBox with other software systems. See Oracle VM VirtualBox Programming Interfaces.

- **Remote machine display.** The VirtualBox Remote Desktop Extension (VRDE) enables high-performance remote access to any running virtual machine. This extension supports the Remote Desktop Protocol (RDP) originally built into Microsoft Windows, with special additions for full client USB support.

  The VRDE does not rely on the RDP server that is built into Microsoft Windows. Instead, the VRDE is plugged directly into the virtualization layer. As a result, it works with guest OSes other than Windows, even in text mode, and does not require application support in the virtual machine either. The VRDE is described in detail in Remote Display (VRDP Support).

  On top of this special capacity, Oracle VM VirtualBox offers you more unique features:

  - **Extensible RDP authentication.**Oracle VM VirtualBox already supports Winlogon on Windows and PAM on Linux for RDP authentication. In addition, it includes an easy-to-use SDK which enables you to create arbitrary interfaces for other methods of authentication. See RDP Authentication.
  - **USB over RDP.** Using RDP virtual channel support, Oracle VM VirtualBox also enables you to connect arbitrary USB devices locally to a virtual machine which is running remotely on an Oracle VM VirtualBox RDP server. See Remote USB.

Supported Host Operating Systems

Currently, Oracle VM VirtualBox runs on the following host OSes:

- **Windows hosts (64-bit):**
  - Windows 10
  - Windows 11
  - Windows Server 2019
  - Windows Server 2022
  - Windows Server 2025
- **macOS hosts (64-bit):**
  - 10.15 (Catalina)
  - 11 (Big Sur)
  - 12 (Monterey)
  - 13 (Ventura)
  - 14 (Sonoma)

  Intel hardware is required. See also Known Limitations.

An installer package is available for macOS/Arm64, for systems using an Apple silicon CPU. With this package, you can run some guest operating systems for Intel x86/x64 CPUs in an emulation.

The macOS/Arm64 installer package for Apple silicon platform is available as a Developer Preview release. This package represents a work in progress project and the performance is very modest.

> **Note:**
>
> Developer Preview is a public release for developers, which provides early access to unsupported software release and features.

- **Linux hosts (64-bit).** Includes the following:
  - Ubuntu 20.04 LTS, 22.04 and 24.04
  - Debian GNU/Linux 10 (Buster), 11 (Bullseye) and 12 (Bookworm)
  - Oracle Linux 7, 8 and 9
  - CentOS/Red Hat Enterprise Linux 7, 8 and 9
  - Fedora 39 and 40
  - SUSE Linux Enterprise server 12 and 15
  - openSUSE Leap 15.3, 15.4 and 15.5

  It should be possible to use Oracle VM VirtualBox on most systems based on Linux kernel 2.6 or later, using either the Oracle VM VirtualBox installer or by doing a manual installation. See Installing on Linux Hosts. However, the formally tested and supported Linux distributions are those for which we offer a dedicated package.

  Note that Linux 2.4-based host OSes are no longer supported.
- **Oracle Solaris hosts (64-bit only).** The following versions are supported with the restrictions listed in Known Limitations:
  - Oracle Solaris 11.4

Note that any feature that is marked as *experimental* is not supported. Feedback and suggestions about such features are welcome.

Host CPU Requirements

SSE2 (Streaming SIMD Extensions 2) support is required for host CPUs.

Installing Oracle VM VirtualBox and Extension Packs

Oracle VM VirtualBox comes in many different packages, and installation depends on your host OS. If you have installed software before, installation should be straightforward. On each host platform, Oracle VM VirtualBox uses the installation method that is most common and easy to use. If you run into trouble or have special requirements, see Installation Details for details about the various installation methods.

Oracle VM VirtualBox is split into the following components:

- **Base package.** The base package consists of all open source components and is licensed under the GNU General Public License V3.

- **Extension packs.** Additional extension packs can be downloaded which extend the functionality of the Oracle VM VirtualBox base package. Currently, Oracle provides a single extension pack, available from: http://www.virtualbox.org. The extension pack provides the following added functionality:
  - VirtualBox Remote Desktop Protocol (VRDP) support. See Remote Display (VRDP Support).
  - Host webcam passthrough. See Webcam Passthrough.
  - Intel PXE boot ROM.
  - Disk image encryption with AES algorithm. See Encryption of Disk Images.
  - Cloud integration features. See Integrating with Oracle Cloud Infrastructure.

  For details of how to install an extension pack, see Installing an Extension Pack.

Starting Oracle VM VirtualBox

After installation, you can start Oracle VM VirtualBox as follows:

- **Windows hosts.** In the **Programs** menu, click on the item in the **VirtualBox** group. On some Windows platforms, you can also enter `VirtualBox` in the search box of the **Start** menu.
- **macOS hosts.** In the Finder, double-click on the **VirtualBox** item in the Applications folder. You may want to drag this item onto your Dock.
- **Linux or Oracle Solaris hosts**. Depending on your desktop environment, an Oracle VM VirtualBox item may have been placed in either the System or System Tools group of your **Applications** menu. Alternatively, you can enter `VirtualBox` in a terminal window.

When you start Oracle VM VirtualBox, the VirtualBox Manager interface is shown. See VirtualBox Manager .

VirtualBox Manager

VirtualBox Manager is the user interface for Oracle VM VirtualBox. You can use VirtualBox Manager to create, configure, and manage your virtual machines.

This section describes the main features of the VirtualBox Manager user interface. Subsequent sections and chapters describe how to use VirtualBox Manager to perform tasks in Oracle VM VirtualBox.

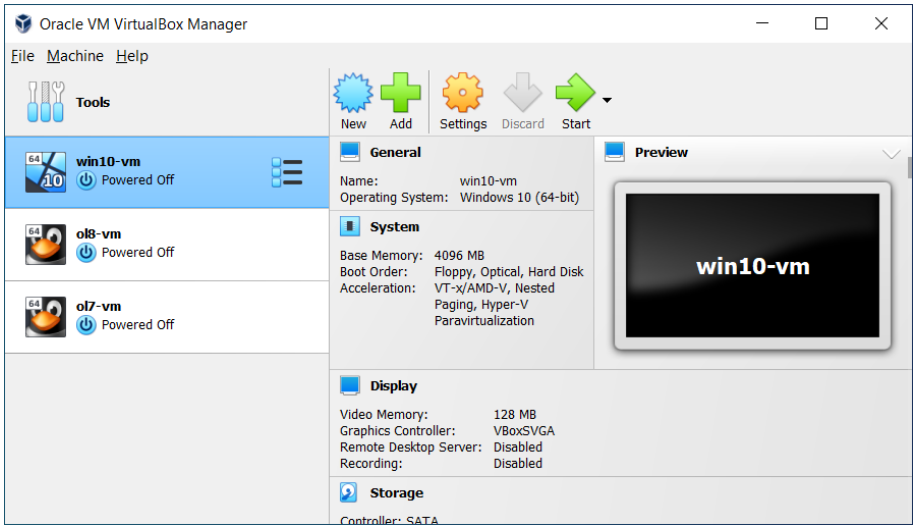
When you start Oracle VM VirtualBox, the **VirtualBox Manager** window is displayed.

Figure 1-2 shows VirtualBox Manager the first time you start Oracle VM VirtualBox, before you have created any virtual machines.

Figure 1-2 VirtualBox Manager, Showing Welcome Screen After Initial Startup

Figure 1-3 shows how VirtualBox Manager might look after you have created some virtual machines.

Figure 1-3 VirtualBox Manager Window, After Creating Virtual Machines



The main components of the VirtualBox Manager window are as follows:

- **The machine list.** The left pane of the **VirtualBox Manager** window lists all your virtual machines. If you have not yet created any virtual machines, this list is empty. See The Machine List.
- **The Details pane.** The pane on the right displays the properties of the currently selected virtual machine. If you do not have any machines yet, the pane displays a welcome message.

  The toolbar buttons on the Details pane can be used to create and work with virtual machines. See The Details Pane.

- **Help Viewer.** A window that displays context-sensitive help topics for VirtualBox Manager tasks. See Help Viewer.

The Machine List

The list of virtual machines in the left pane is called the *machine list*.

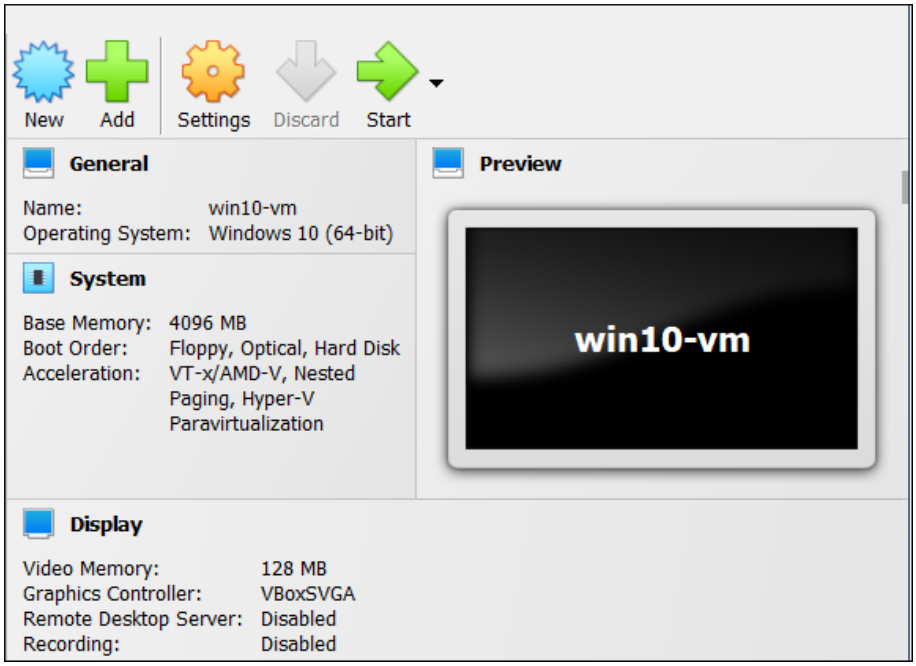
The following methods can be used to control and configure virtual machines in the machine list:

- Right-click on the virtual machine name, to display menu options.
- Click on the Machine Tools menu, to the right of the virtual machine name. See Machine Tools.
- Click a button in the toolbar in the Details pane. See The Details Pane.

The Details Pane

The Details pane shows configuration information for a virtual machine that is selected in the machine list. The pane also includes a toolbar for performing tasks.

Figure 1-4 VirtualBox Manager Details Pane, Including Toolbar



The Details pane includes the following:

VirtualBox Manager Toolbar

A toolbar at the top of the Details pane contains buttons that enable you to configure the selected virtual machine, or to create a new virtual machine.

The toolbar includes the following buttons:

- **New.** Creates a new virtual machine, and adds it to the machine list.
- **Add.** Adds an existing virtual machine to the machine list.
- **Settings.** Displays the **Settings** window for the virtual machine, enabling you to make configuration changes.
- **Discard.** For a running virtual machine, discards the saved state for the virtual machine and closes it down.
- **Show/Start.** For a running virtual machine, **Show** displays the virtual machine window. For a stopped virtual machine, **Start** displays options for powering up the virtual machine.

Settings

A summary of settings is shown for the virtual machine.

You can change some virtual machine settings, by clicking on the setting in the Details pane.

> **Note:**
>
> If a virtual machine is running, some settings cannot be altered. You must stop the virtual machine first in order to change the setting.

Virtual machine settings can also be changed using the **Settings** button on the VirtualBox Manager toolbar.

The virtual machine settings on the Details pane are organized in sections that correspond to those used in the **Settings** window. See Configuring Virtual Machines.

Click the arrow icon to hide or show each section.

Preview Window

The virtual machine display is shown in a small window.

You can use the Preview window to check if your virtual machine has finished booting up.

Click the arrow icon to hide or show the Preview window.

Notification Center

Notification messages may be shown in a sliding panel on the right of the Details pane, called the **Notification Center**. Click the warning triangle to show the notification messages.

Most system messages that do not require user interaction are displayed in the Notification Center, including task failure alerts.

The progress of some tasks can be observed and stopped using the Notification Center.

VirtualBox Manager Tools

VirtualBox Manager provides two types of user tools, to enable you to perform common tasks easily.

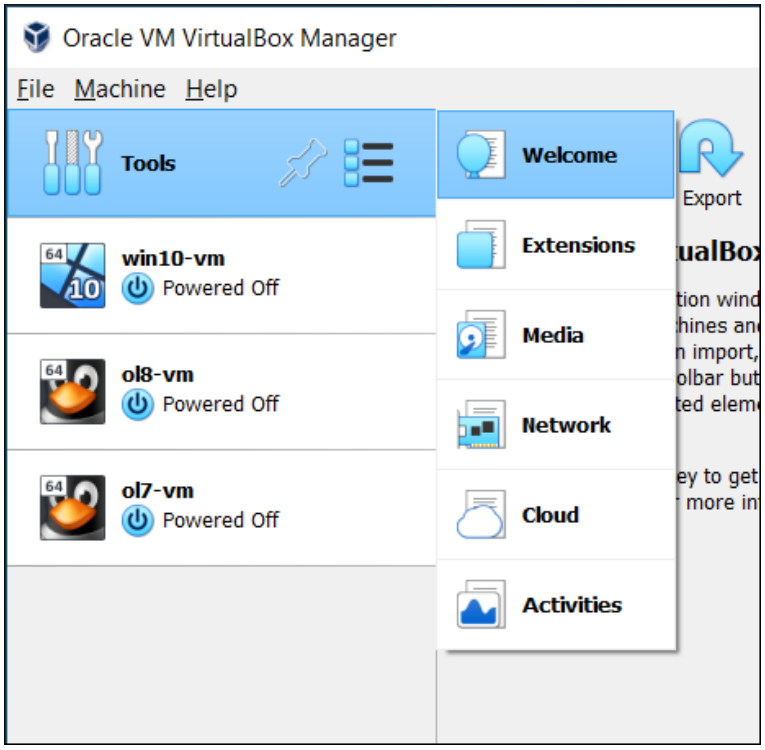
- **Global Tools.** These tools apply to *all* virtual machines. See Global Tools.

- **Machine Tools.** These tools apply to a *specific* virtual machine. See Machine Tools.

Global Tools

In the left pane of the VirtualBox Manager window, click the **Menu** icon in the **Tools** banner located above the machine list. The **Global Tools** menu is displayed.

Figure 1-5 Global Tools Menu



A drop-down list enables you to select from the following global tools:

- **Welcome.** Displays the VirtualBox Manager welcome message. The VirtualBox Manager toolbar is also included, to enable you to get started with using Oracle VM VirtualBox. See Figure 1-2.
- **Extensions.** Displays the **Extension Pack Manager** tool. This tool is used to install and uninstall Oracle VM VirtualBox Extension Packs. See The Extension Pack Manager.
- **Media.** Displays the **Virtual Media Manager** tool. This tool is used to manage the disk images used by Oracle VM VirtualBox. See The Virtual Media Manager.
- **Network.** Displays the **Network Manager** tool. This tool is used to create and configure some types of networks used by Oracle VM VirtualBox. See Network Manager.
- **Cloud.** Displays the **Cloud Profile Editor** tool. This tool is used to configure connections to a cloud service, such as Oracle Cloud Infrastructure. See Using the Cloud Profile Manager.
- **Activities.** Displays the **VM Activity Overview** tool. This tool is used to monitor performance and resource usage of virtual machines. See Monitoring of Virtual Machines.

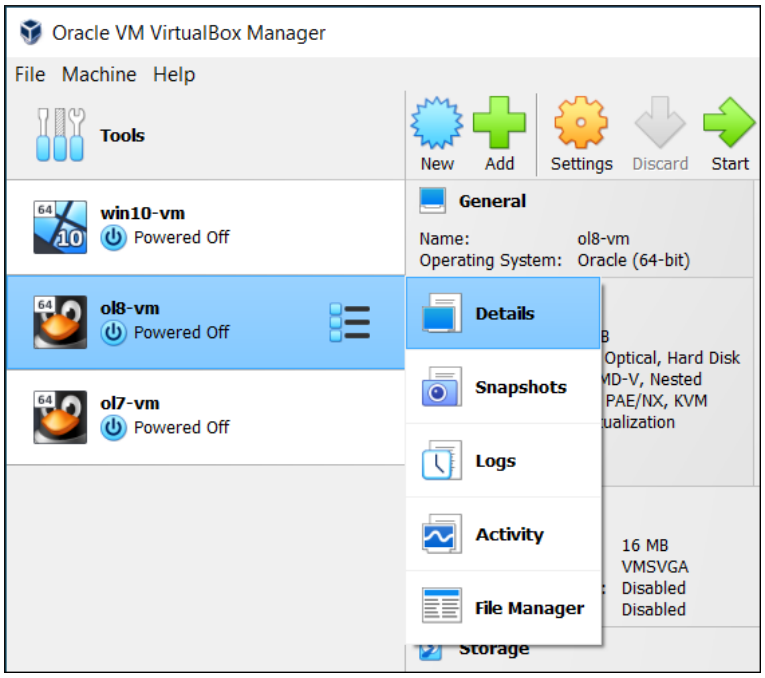
The **Pin** icon is used to keep the **Tools** banner visible as you scroll down the entries in the machine list.

Machine Tools

In the machine list in the left pane of the VirtualBox Manager window, select a virtual machine.

Click the **Menu** icon to the right of the virtual machine name. The **Machine Tools** menu is displayed.

Figure 1-6 Machine Tools Menu



A drop-down list enables you to select from the following machine tools:

- **Details.** Displays the Details pane for the selected virtual machine. See The Details Pane.
- **Snapshots.** Displays the **Snapshots** tool. This tool enables you to view and manage snapshots for the virtual machine. See Snapshots.
- **Logs.** Displays the **Log Viewer** tool. This tool enables you to view and search system logs for the virtual machine. See The Log Viewer.
- **Activity.** Displays the **VM Activity** page of the **Session Information** dialog. This dialog enables you to view and analyze performance metrics for the virtual machine. See Monitoring of Virtual Machines.
- **File Manager.** Displays the **Guest Control File Manager** tool. This tool enables you to manage files on the guest system. See Guest Control File Manager.

Help Viewer

The Help Viewer is a window that displays context-sensitive help to assist you in completing common VirtualBox Manager tasks. You can display the Help Viewer in the following ways:

- In a VirtualBox Manager wizard or dialog, click **Help** to display the relevant help topic.

- In VirtualBox Manager or from a guest VM, do either of the following:
  - Select the **Help**, **Contents** menu option.
  - Press the **F1** button.

    The keyboard shortcut used to access the Help Viewer can be configured in the **Preferences** window.

The Help Viewer has the following features:

- **Navigation tools.** The left hand pane contains the following navigation tools:
  - **Contents.** Displays the help topic location in the Oracle VM VirtualBox documentation.
  - **Search.** Enables you to search the documentation for help topics.
  - **Bookmarks.** Enables you to bookmark useful help topics.
- **Tabbed browsing.** Help topics that you have visited are displayed in tabs in the main window pane.
- **Zoomable topics.** Zoom controls enable you to enlarge help topic details.
- **Printing.** Help topics can be printed to PDF file or to a local printer.

About VirtualBox Manager Wizards

VirtualBox Manager includes wizards that enable you to complete tasks easily. Examples of such tasks are when you create a new virtual machine or use the cloud integration features of Oracle VM VirtualBox.

To display a help topic for the wizard, click the **Help** button.

Some wizards can be displayed in either of the following modes:

- **Guided mode.** This is the default display mode. Wizards are shown in the conventional manner, using a series of pages with descriptions to guide the user through the steps for a task.
- **Expert mode.** This display mode is designed for more advanced users of Oracle VM VirtualBox. All settings are displayed on a single page, enabling quicker completion of tasks.

Click the button at the bottom of the wizard window to switch between Guided mode and Expert mode.

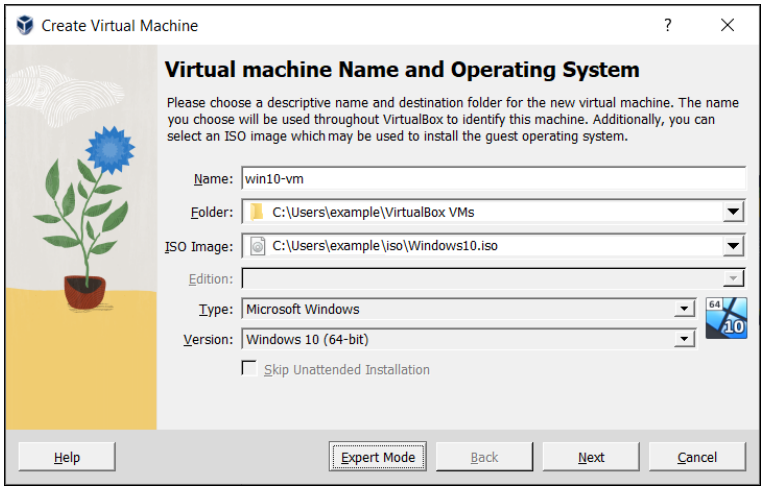
Creating Your First Virtual Machine

Click **New** in the VirtualBox Manager window. The **Create Virtual Machine** wizard is shown, to guide you through the required steps for setting up a new virtual machine (VM).

The **Create Virtual Machine** wizard pages are described in the following sections.

Create Virtual Machine Wizard: Name and Operating System

Figure 1-7 Creating a Virtual Machine: Name and Operating System



Use this page to specify a name and operating system (OS) for the virtual machine and to change the storage location used for VMs.

You can also choose to disable the unattended guest operating system install feature. See also (Optional) Create Virtual Machine Wizard: Unattended Guest OS Install.

The following fields are available on this wizard page:

- **Name.** A name for the new VM. The name you enter is shown in the machine list of VirtualBox Manager and is also used for the virtual machine's files on disk.

  Be sure to assign each VM an informative name that describes the OS and software running on the VM. For example, a name such as `Windows 10 with Visio`.

- **Folder.** The location where VMs are stored on your computer, called the *machine folder*. The default folder location is shown.

  Ensure that the folder location has enough free space, especially if you intend to use the snapshots feature. See also The Machine Folder.

- **ISO Image.** Select an ISO image file. The image file can be used to install an OS on the new virtual machine or it can be attached to a DVD drive on the new virtual machine.

- **Type and Version.** These fields are used to select the OS that you want to install on the new virtual machine.

  The supported OSes are grouped into types. If you want to install something very unusual that is not listed, select the **Other** type. Depending on your selection, Oracle VM VirtualBox will enable or disable certain VM settings that your guest OS may require. This is particularly important for 64-bit guests. See 64-bit Guests. It is therefore recommended to always set this field to the correct value.

  If an ISO image is selected and Oracle VM VirtualBox detects the operating system for the ISO, the **Type** and **Version** fields are populated automatically and are disabled.

- **Skip Unattended Installation.** Disables unattended guest OS installation, even if an ISO image is selected that supports unattended installation. In that case, the selected ISO

image is mounted automatically on the DVD drive of the new virtual machine and user interaction is required to complete the OS installation.

The unattended installation step in the wizard is skipped.

> **Note:**
>
> This option is disabled if you do not select an installation medium in the **ISO Image** field.

Click **Next** to go to the next wizard page.

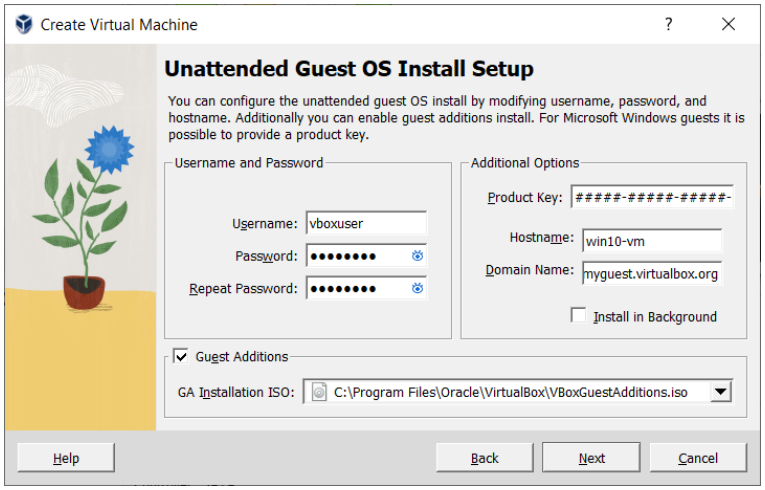
(Optional) Create Virtual Machine Wizard: Unattended Guest OS Install

Unattended guest OS installation enables you to install the OS on a virtual machine automatically.

> **Note:**
>
> This page is optional. It is not displayed if you have selected the **Skip Unattended Installation** option on the initial wizard page.

Use this page to set up the required parameters for unattended guest OS installation and to configure automatic installation of the Oracle VM VirtualBox Guest Additions. See also Some Examples of Unattended Installation for some typical scenarios when using automated installation.

Figure 1-8 Creating a Virtual Machine: Unattended Guest OS Installation



The following fields are available on this wizard page:

- **Username and Password.** Enter the credentials for a default user on the guest OS.

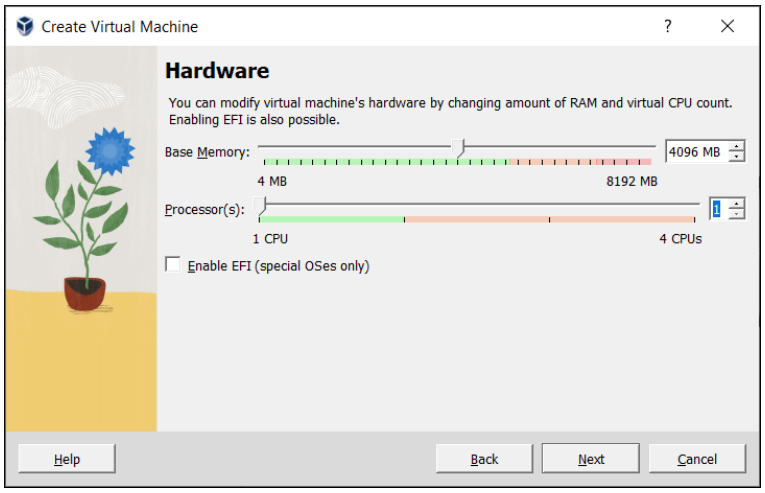
- **Guest Additions.** Enables automatic installation of the Guest Additions, following installation of the guest OS. Use the drop-down list to select the location of the ISO image file for the Guest Additions.
- **Additional Options.** The following options enable you to perform extra configuration of the guest OS:
  - **Product Key.** For Windows guests only. Enter the product key required for Windows installation.
  - **Hostname.** Host name for the guest. By default, this is the same as the VM name.
  - **Domain Name.** Domain name for the guest.
  - **Install in Background.** Enable headless mode for the VM, where a graphical user interface is not shown.

Click **Next** to go to the next wizard page.

Create Virtual Machine Wizard: Hardware

Use this page to configure hardware settings for the virtual machine.

Figure 1-9 Creating a Virtual Machine: Hardware



The following fields are available on this wizard page:

- **Base Memory.** Select the amount of RAM that Oracle VM VirtualBox should allocate every time the virtual machine is started. The amount of memory selected here will be taken away from your host machine and presented to the guest OS, which will report this size as the virtual machines installed RAM.

> **Caution:**
>
> Choose this setting carefully. The memory you give to the VM will not be available to your host OS while the VM is running, so do not specify more than you can spare.
>
> For example, if your host machine has 4 GB of RAM and you enter 2048 MB as the amount of RAM for a particular virtual machine, you will only have 2 GB left for all the other software on your host while the VM is running. If you run two VMs at the same time, even more memory will be allocated for the second VM, which may not even be able to start if that memory is not available.
>
> On the other hand, you should specify as much as your guest OS and your applications will require to run properly. A guest OS may require at least 1 or 2 GB of memory to install and boot up. For best performance, more memory than that may be required.

Always ensure that the host OS has enough RAM remaining. If insufficient RAM remains, the system might excessively swap memory to the hard disk, which effectively brings the host system to a standstill.

As with other **Create Virtual Machine** wizard settings, you can change this setting later, after you have created the VM.

- **Processor(s).** Select the number of virtual processors to assign to the VM.

  It is not advised to assign more than half of the total processor threads from the host machine.

- **Enable EFI.** Enables Extensible Firware Interface (EFI) booting for the guest OS.

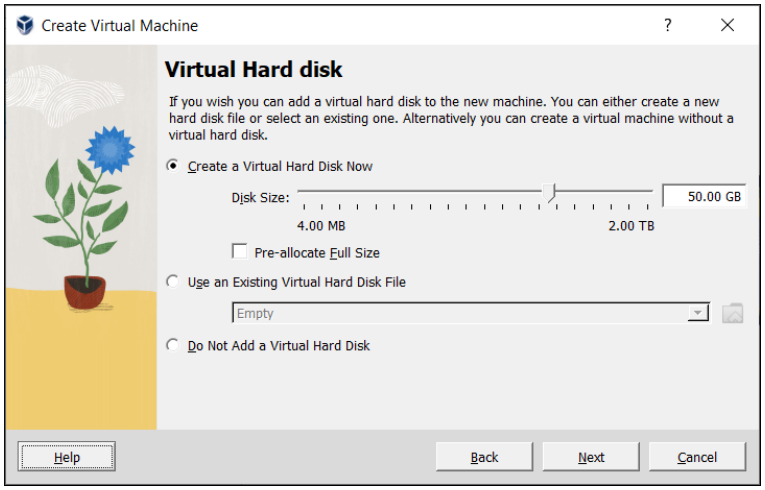
Click **Next** to go to the next wizard page.

Create Virtual Machine Wizard: Virtual Hard Disk

Use this page to specify a virtual hard disk for the virtual machine.

There are many ways in which Oracle VM VirtualBox can provide hard disk space to a VM, see Virtual Storage. The most common way is to use a large image file on your physical hard disk, whose contents Oracle VM VirtualBox presents to your VM as if it were a complete hard disk. This file then represents an entire hard disk, so you can even copy it to another host and use it with another Oracle VM VirtualBox installation.

Figure 1-10 Creating a New Virtual Machine: Virtual Hard Disk



The following fields are available on this wizard page:

- **Create a Virtual Hard Disk Now**. Creates a new empty virtual hard disk image, located in the VM's machine folder.

  Enter the following settings:

  – **Disk Size**. Use the slider to select a maximum size for the hard disk in the new VM.

  – **Pre-Allocate Full Size.** This setting determines the type of image file used for the disk image. Select this setting to use a *fixed-size file* for the disk image. Deselect this setting to use a *dynamically allocated file* for the disk image.

    The different types of image file behave as follows:

    * **Dynamically allocated file.** This type of image file only grows in size when the guest actually stores data on its virtual hard disk. Therefore, this file is small initially. As the drive is filled with data, the file grows to the specified size.

    * **Fixed-size file.** This type of image file immediately occupies the file specified, even if only a fraction of that virtual hard disk space is actually in use. While occupying much more space, a fixed-size file incurs less overhead and is therefore slightly faster than a dynamically allocated file.

    For more details about the differences, see Disk Image Files (VDI, VMDK, VHD, HDD).

- **Use an Existing Hard Disk File.** Enables you to select an *existing* disk image file to use with the new VM.

  The drop-down list presented in the window lists all disk images which are known by Oracle VM VirtualBox. These disk images are currently attached to a virtual machine, or have been attached to a virtual machine.

  Alternatively, click on the small folder icon next to the drop-down list. In the **Hard Disk Selector** window that is displayed, click **Add** to select a disk image file on your host disk.

- **Do Not Add a Virtual Hard Disk.** The new VM is created without a hard disk.

To prevent your physical hard disk on the host OS from filling up, Oracle VM VirtualBox limits the size of the image file. But the image file must be large enough to hold the contents of the guest OS and the applications you want to install. For a Windows or Linux guest, you will probably need several gigabytes for any serious use. The limit of the image file size can be changed later, see VBoxManage modifymedium.

> **Note:**
>
> You can skip attaching a virtual hard disk file to the new virtual machine you are creating. But you will then need to attach an hard disk later on, in order to install a guest operating system.

After having selected or created your image file, click **Next** to go to the next wizard page.

Create Virtual Machine Wizard: Summary

This page displays a summary of the configuration for the virtual machine.

If you are not happy with any of the settings, use the **Back** button to return to the corresponding page and modify the setting.

Click **Finish** to create your new virtual machine. The virtual machine is displayed in the machine list on the left side of the VirtualBox Manager window, with the name that you entered on the first page of the wizard.

Some Examples of Unattended Installation

To configure unattended installation, you typically just need to specify an ISO image in the **Create Virtual Machine** wizard. Oracle VM VirtualBox then detects the OS type and the unattended installation process is done automatically when the wizard is completed. However, in some situations the installation may need be completed manually.

The following list describes some common scenarios for unattended installation:

- **OS type is detected automatically.** The following outcomes are possible:
  - If unattended installation is supported for the selected ISO, the guest OS is installed automatically. No user input is required.
  - If unattended installation is not supported for the selected ISO, the ISO image is inserted automatically into the DVD drive of the new VM. The guest OS installation must then be completed manually.
- **OS type is not detected automatically.** You must configure **Type** and **Version** settings in the wizard.

  The ISO image is inserted automatically into the DVD drive of the new VM. The guest OS installation must then be completed manually.
- **Unattended Installation is disabled.** Users can disable unattended installation, by selecting the **Skip Unattended Installation** check box on the initial wizard page.

  The ISO image is inserted automatically into the DVD drive of the new VM. The guest OS installation must then be completed manually.

See also Unattended Guest Installation for details of how to perform unattended installation from the command line.

Running Your Virtual Machine

To start a virtual machine, you have the following options:

- Double-click on the VM's entry in the machine list in VirtualBox Manager.

- Select the VM's entry in the machine list in VirtualBox Manager, and click **Start** in the toolbar the top of the window.
- Go to the `VirtualBox VMs` folder in your system user's home directory. Find the subdirectory of the machine you want to start and double-click on the machine settings file. This file has a `.vbox` file extension.

Starting a virtual machine displays a new window, and the virtual machine which you selected will boot up. Everything which would normally be seen on the virtual system's monitor is shown in the window. See Figure 1-1.

In general, you can use the virtual machine as you would use a real computer. The following topics describe a few points to note when running a VM.

Starting a New VM for the First Time

When you start a VM for the first time the OS installation process is started automatically, using the ISO image file specified in the **Create Virtual Machine** wizard.

Follow the onscreen instructions to install your OS.

Virtual Machine Status Bar

A status bar is displayed at the bottom of the virtual machine window. The status bar contains icons that enable you to view and change settings for the virtual machine, as follows:

- Highlight an icon to show details of the current settings.
- Right-click an icon to change a setting.

  Some settings, such as audio, can be changed directly by right-clicking the status bar icon. For other settings, you select from the displayed menu options.

See Configuring Virtual Machines for detailed information about the available virtual machine settings.

Table 1-1 describes the icons on the status bar.

Table 1-1 Virtual Machine Status Bar Icons

Icon	Description
	Storage (SATA) Settings for attached SATA storage devices, such as hard disk drives. See also Storage Settings.
	Storage (IDE) Settings for attached IDE storage devices, such as optical CD-ROM drives. See also Storage Settings. Right-click to show options for adding and removing IDE devices. See also Changing Removable Media.

Table 1-1 (Cont.) Virtual Machine Status Bar Icons

Icon	Description
	Audio Settings for audio output and audio input. Right-click to change a setting. The status bar icon is updated automatically to show which settings are enabled. See also Audio Settings.
	Network Settings for attached network adapters. Right-click to connect or disconnect a network adapter. See also Network Settings.
	USB Settings for attached USB devices. Right-click to select from the available USB devices on the host and to specify a USB filter. See also USB Settings.
	Shared Folders Settings for shared folders. Right-click to change shared folder settings or to add a new shared folder. See also Shared Folders.
	Display Settings for the virtual machine display. Right-click to show options for resizing and scaling the display. See also Resizing the Machine's Window.

Table 1-1 (Cont.) Virtual Machine Status Bar Icons

Icon	Description
	Recording Settings for video and audio recording. Right-click to show options to enable and disable recording, or to change recording settings. To enable recording, right-click on the status bar and select the **Recording** option. The icon changes to show a movie reel animation, as follows: To disable recording, right-click on the status bar and deselect the **Recording** option. The icon changes back to the default image. See also Recording Tab.
	Processor Settings for the CPU used by the virtual machine. The colored bar in the icon indicates current processor activity. Red indicates high CPU usage, Green indicates low CPU usage. A green turtle icon indicates that a native hypervisor, such as Hyper-V, is running on the host. See also Processor Tab.
	Mouse Integration Settings for capturing the host mouse pointer. Right-click to enable or disable mouse integration. See also Capturing and Releasing Keyboard and Mouse.

Table 1-1 (Cont.) Virtual Machine Status Bar Icons

Icon	Description
	Host Key Settings for capturing the host keyboard. The current host key setting is displayed to the right of the icon. Right-click to show options for configuring the host key combination and other keyboard shortcuts. Right-click to insert a special key combination, such as Ctrl-Alt-Del. See also Typing Special Characters.

Configuring the Status Bar

You can configure the status bar as follows:

- To **hide** the status bar, right-click in the status bar area and deselect **Show Status Bar**.
- To **show** the status bar, select **View**, **Status Bar**, **Show Status Bar** from the virtual machine's menu bar.
- To **modify** the status bar contents, right-click in the status bar area and select **Status Bar Settings**. You can then do the following:
  - Select icons that you want to include in the status bar.
  - Deselect icons that you want to remove from the status bar.
  - Drag and drop icons to change their order in the status bar.

  Click the check mark button to save your changes to the status bar.

  See also User Interface for other options to change the status bar.

Capturing and Releasing Keyboard and Mouse

Oracle VM VirtualBox provides a virtual USB tablet device to new virtual machines through which mouse events are communicated to the guest OS. If you are running a modern guest OS that can handle such devices, mouse support may work out of the box without the mouse being *captured* as described below. See Motherboard Tab.

Otherwise, if the virtual machine detects only standard PS/2 mouse and keyboard devices, since the OS in the virtual machine does not know that it is not running on a real computer, it expects to have exclusive control over your keyboard and mouse. But unless you are running the VM in full screen mode, your VM needs to share keyboard and mouse with other applications and possibly other VMs on your host.

After installing a guest OS and before you install the Guest Additions, described in Guest Additions, either your VM or the rest of your computer can *own* the keyboard and the mouse. Both cannot own the keyboard and mouse at the same time. You will see a *second* mouse pointer which is always confined to the limits of the VM window. You activate the VM by clicking inside it.

To return ownership of keyboard and mouse to your host OS, Oracle VM VirtualBox reserves a special key on your keyboard: the *Host key*. By default, this is the *right Ctrl key* on your keyboard. On a Mac host, the default Host key is the left Command key. You can change this

default using the Preferences window. See Preferences. The current setting for the Host key is always displayed at the bottom right of your VM window.

Figure 1-11 Host Key Setting on the Virtual Machine Status Bar

This means the following:

- Your **keyboard** is owned by the VM if the VM window on your host desktop has the keyboard focus. If you have many windows open in your guest OS, the window that has the focus in your VM is used. This means that if you want to enter text within your VM, click on the title bar of your VM window first.

  To release keyboard ownership, press the Host key. As explained above, this is typically the right Ctrl key.

  Note that while the VM owns the keyboard, some key sequences, such as Alt+Tab, will no longer be seen by the host, but will go to the guest instead. After you press the Host key to reenable the host keyboard, all key presses will go through the host again, so that sequences such as Alt+Tab will no longer reach the guest. For technical reasons it may not be possible for the VM to get all keyboard input even when it does own the keyboard. Examples of this are the Ctrl+Alt+Del sequence on Windows hosts or single keys grabbed by other applications on X11 hosts such as the GNOME desktop Locate Pointer feature.
- Your **mouse** is owned by the VM only after you have clicked in the VM window. The host mouse pointer will disappear, and your mouse will drive the guest's pointer instead of your normal mouse pointer.

  Note that mouse ownership is independent of that of the keyboard. Even after you have clicked on a titlebar to be able to enter text into the VM window, your mouse is not necessarily owned by the VM yet.

  To release ownership of your mouse by the VM, press the Host key.

As this behavior is inconvenient, Oracle VM VirtualBox provides a set of tools and device drivers for guest systems called the Oracle VM VirtualBox Guest Additions. These tools make VM keyboard and mouse operations much more seamless. Most importantly, the Guest Additions suppress the second "guest" mouse pointer and make your host mouse pointer work directly in the guest. See Guest Additions.

Typing Special Characters

Some OSes expect certain key combinations to initiate certain procedures. The key combinations that you type into a VM might target the host OS, the Oracle VM VirtualBox software, or the guest OS. The recipient of these keypresses depends on a number of factors, including the key combination itself.

- Host OSes reserve certain key combinations for themselves. For example, you cannot use the **Ctrl+Alt+Delete** combination to reboot the guest OS in your VM, because this key combination is reserved by the host OS. Even though both Windows and Linux OSes can intercept this key combination, the host OS is rebooted automatically.

  On Linux and Oracle Solaris hosts, which use the X Window System, the key combination **Ctrl+Alt+Backspace** normally resets the X server and restarts the entire graphical user interface. As the X server intercepts this combination, pressing it will usually restart your

host graphical user interface and kill all running programs, including Oracle VM VirtualBox, in the process.

On Linux hosts supporting virtual terminals, the key combination **Ctrl+Alt+Fx**, where Fx is one of the function keys from F1 to F12, normally enables you to switch between virtual terminals. As with **Ctrl+Alt+Delete**, these combinations are intercepted by the host OS and therefore always switch terminals on the *host*.

If, instead, you want to send these key combinations to the *guest* OS in the virtual machine, you will need to use one of the following methods:

– Use the items in the **Input**, **Keyboard** menu of the virtual machine window. This menu includes the settings **Insert Ctrl+Alt+Delete** and **Insert Ctrl+Alt+Backspace**. However, the latter setting affects only Linux guests or Oracle Solaris guests.

  This menu also includes an option for inserting the Host key combination.

– Use special key combinations with the Host key, which is normally the right Control key. Oracle VM VirtualBox then translates the following key combinations for the VM:

  * **Host key + Del** sends **Ctrl+Alt+Del** to reboot the guest OS.

  * **Host key + Backspace** sends **Ctrl+Alt+Backspace** to restart the graphical user interface of a Linux or Oracle Solaris guest.

  * **Host key + Function key**. For example, use this key combination to simulate **Ctrl+Alt+Fx** to switch between virtual terminals in a Linux guest.

- For some other keyboard combinations such as **Alt+Tab** to switch between open windows, Oracle VM VirtualBox enables you to configure whether these combinations will affect the host or the guest, if a virtual machine currently has the focus. This is a global setting for all virtual machines and can be found under **File**, **Preferences**, **Input**.
- A soft keyboard can be used to input key combinations in the guest. See Soft Keyboard.

Changing Removable Media

While a virtual machine is running, you can change removable media in the **Devices** menu of the VM's window. Here you can select in detail what Oracle VM VirtualBox presents to your VM as a CD, DVD, or floppy drive.

The settings are the same as those available for the VM in the **Settings** window of VirtualBox Manager. But as the **Settings** window is disabled while the VM is in the Running or Saved state, the **Devices** menu saves you from having to shut down and restart the VM every time you want to change media.

Using the **Devices** menu, you can attach the host drive to the guest or select a floppy or DVD image, as described in Storage Settings.

The **Devices** menu also includes an option for creating a virtual ISO (VISO) from selected files on the host.

Resizing the Machine's Window

You can resize the VM's window while that VM is running. When you do, the window is scaled as follows:

- If you have **scaled mode** enabled, then the virtual machine's screen will be scaled to the size of the window. This can be useful if you have many machines running and want to have a look at one of them while it is running in the background. Alternatively, it might be useful to enlarge a window if the VM's output screen is very small, for example because you are running an old OS in it.

To enable scaled mode, press **Host key + C**, or select **Scaled Mode** from the **View** menu in the VM window. To leave scaled mode, press **Host key + C** again.

The aspect ratio of the guest screen is preserved when resizing the window. To ignore the aspect ratio, press **Shift** during the resize operation.

See Known Limitations for additional remarks.

- If you have the Guest Additions installed and they support automatic **resizing**, the Guest Additions will automatically adjust the screen resolution of the guest OS. For example, if you are running a Windows guest with a resolution of 1024x768 pixels and you then resize the VM window to make it 100 pixels wider, the Guest Additions will change the Windows display resolution to 1124x768.

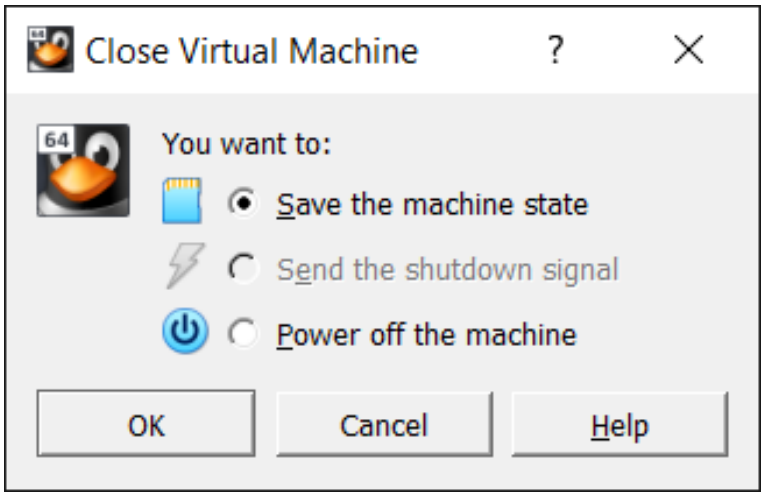
  See Guest Additions.

- Otherwise, if the window is bigger than the VM's screen, the screen will be centered. If it is smaller, then scroll bars will be added to the machine window.

Saving the State of the Machine

When you click on the **Close** button of your virtual machine window, at the top right of the window, just like you would close any other window on your system, Oracle VM VirtualBox asks you whether you want to save or power off the VM. As a shortcut, you can also press **Host key + Q**.

Figure 1-12 Closing Down a Virtual Machine



The difference between the three options is crucial. They mean the following:

- **Save the machine state:** With this option, Oracle VM VirtualBox *freezes* the virtual machine by completely saving its state to your local disk.

  When you start the VM again later, you will find that the VM continues exactly where it was left off. All your programs will still be open, and your computer resumes operation. Saving the state of a virtual machine is thus in some ways similar to suspending a laptop computer by closing its lid.

- **Send the shutdown signal.** This will send an ACPI shutdown signal to the virtual machine, which has the same effect as if you had pressed the power button on a real computer. This should trigger a proper shutdown mechanism from within the VM.

- **Power off the machine:** With this option, Oracle VM VirtualBox also stops running the virtual machine, but *without* saving its state.

  > **Caution:**
  >
  > This is equivalent to pulling the power plug on a real computer without shutting it down properly. If you start the machine again after powering it off, your OS will have to reboot completely and may begin a lengthy check of its virtual system disks. As a result, this should not normally be done, since it can potentially cause data loss or an inconsistent state of the guest system on disk.

  As an exception, if your virtual machine has any snapshots, see Snapshots, you can use this option to quickly **restore the current snapshot** of the virtual machine. In that case, powering off the machine will discard the current state and any changes made since the previous snapshot was taken will be lost.

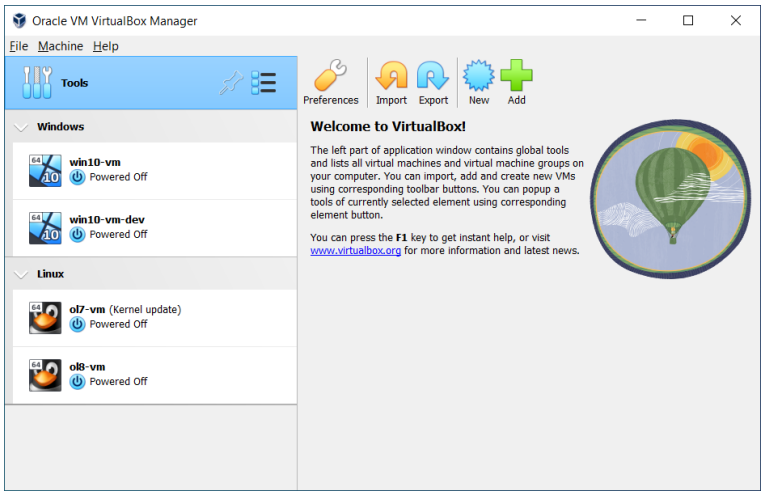
The **Discard** button in the VirtualBox Manager window discards a virtual machine's saved state. This has the same effect as powering it off, and the same warnings apply.

Using VM Groups

VM groups are groups of VMs that you can create as and when required. You can manage and perform functions on them collectively, as well as individually.

The following figure shows VM groups displayed in VirtualBox Manager.

Figure 1-13 Groups of Virtual Machines



The following features are available for groups:

- Create a group using VirtualBox Manager. Do one of the following:
  - Drag a VM on top of another VM.
  - Select multiple VMs and select **Group** from the right-click menu.
- Create and manage a group using the command line. Do one of the following:

  - Create a group and assign a VM. For example:

    ```
    VBoxManage modifyvm "vm01" --groups "/TestGroup"
    ```

    This command creates a group `TestGroup` and attaches the VM `vm01` to that group.

  - Detach a VM from the group, and delete the group if empty. For example:

    ```
    VBoxManage modifyvm "vm01" --groups ""
    ```

    This command detaches all groups from the VM `vm01` and deletes the empty group.

- Create multiple groups. For example:

  ```
  VBoxManage modifyvm "vm01" --groups "/TestGroup,/TestGroup2"
  ```

  This command creates the groups `TestGroup` and `TestGroup2`, if they do not exist, and attaches the VM `vm01` to both of them.

- Create nested groups, having a group hierarchy. For example:

  ```
  VBoxManage modifyvm "vm01" --groups "/TestGroup/TestGroup2"
  ```

  This command attaches the VM `vm01` to the subgroup `TestGroup2` of the `TestGroup` group.

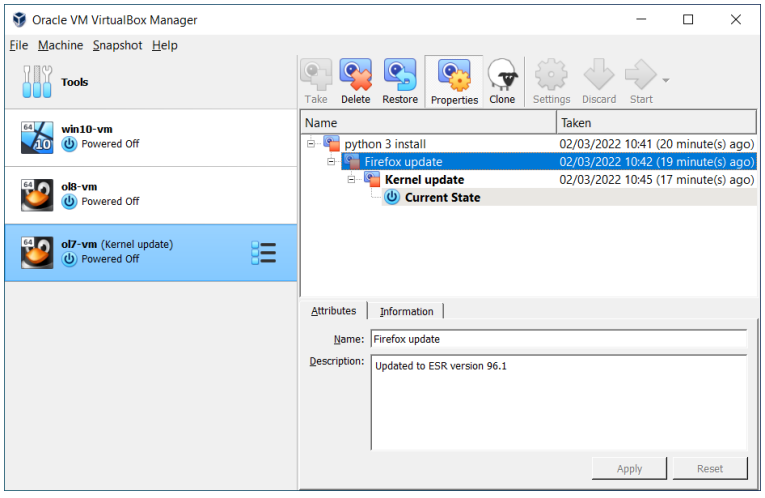
- Use VirtualBox Manager menu options to control and manage all the VMs in a group. For example: **Start**, **Pause**, **Reset**, **Close** (save state, send shutdown signal, poweroff), **Discard Saved State**, **Show in Explorer**, **Sort**.

Snapshots

With snapshots, you can save a particular state of a virtual machine for later use. At any later time, you can revert to that state, even though you may have changed the VM considerably since then. A snapshot of a virtual machine is thus similar to a machine in Saved state, but there can be many of them, and these saved states are preserved.

To see the snapshots of a virtual machine, click on the machine name in VirtualBox Manager. In the machine tools menu for the VM, click **Snapshots**. The Snapshots tool is displayed.

Figure 1-14 Snapshots Tool, Showing Snapshot Properties



If you select multiple VMs in the machine list, all snapshots are listed for each VM.

Until you take a snapshot of the virtual machine, the list of snapshots will be empty, except for the **Current State** item. This item represents the current point in the lifetime of the virtual machine.

The Snapshots window includes a toolbar, enabling you to perform the following snapshot operations:

- **Take.** Takes a snapshot of the selected VM. See Taking, Restoring, and Deleting Snapshots.
- **Delete.** Removes a snapshot from the list of snapshots. See Taking, Restoring, and Deleting Snapshots.
- **Restore.** Restores the VM state to be the same as the selected snapshot. See Taking, Restoring, and Deleting Snapshots.
- **Properties.** Displays the properties for the selected snapshot. The **Attributes** tab is used to specify a Name and Description for the snapshot. The **Information** tab shows VM settings for the snapshot.
- **Clone.** Displays the **Clone Virtual Machine** wizard. This enables you to create a clone of the VM, based on the selected snapshot.
- **Settings.** Available for the Current State snapshot only. Displays the **Settings** window for the VM, enabling you to make configuration changes.
- **Discard.** For a running VM, discards the saved state for the VM and closes it down.
- **Start.** Start the VM. This operation is available for the **Current State** item.

Taking, Restoring, and Deleting Snapshots

There are three operations related to snapshots, as follows:

1. **Take a snapshot.** This makes a copy of the machine's current state, to which you can go back at any given time later.

   - If your VM is running:

     Select **Take Snapshot** from the **Machine** menu in the VM window.

     The VM is paused while the snapshot is being created. After snapshot creation, the VM continues to run as normal.

   - If your VM is in either the Saved or the Powered Off state, as displayed next to the VM name in the machine list:

     Display the Snapshots window and do one of the following:

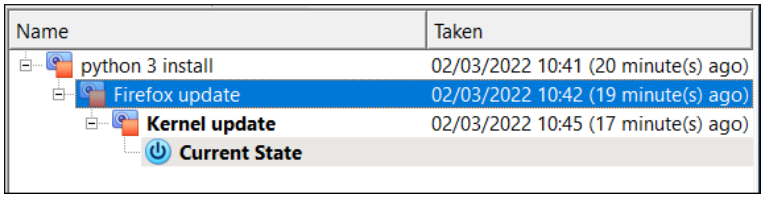
     – Click **Take** in the Snapshots window toolbar.

     – Right-click on the **Current State** item in the list and select **Take**.

   A dialog is displayed, prompting you for a snapshot name. This name is purely for reference purposes, to help you remember the state of the snapshot. For example, a useful name would be "Fresh installation from scratch, no Guest Additions", or "Service Pack 3 just installed". You can also add a longer text description in the **Snapshot Description** field.

   Your new snapshot will then appear in the snapshots list. Underneath your new snapshot, you will see an item called **Current State**, signifying that the current state of your VM is a variation based on the snapshot you took earlier. If you later take another snapshot, you will see that they are displayed in sequence, and that each subsequent snapshot is derived from an earlier one.

Figure 1-15 Snapshots List For a Virtual Machine



Oracle VM VirtualBox imposes no limits on the number of snapshots you can take. The only practical limitation is disk space on your host. Each snapshot stores the state of the virtual machine and thus occupies some disk space. See Snapshot Contents for details on what is stored in a snapshot.

2. **Restore a snapshot.** In the Snapshots window, select the snapshot you have taken and click **Restore** in the toolbar. By restoring a snapshot, you go back or forward in time. The current state of the machine is lost, and the machine is restored to the exact state it was in when the snapshot was taken.

> **Note:**
>
> Restoring a snapshot will affect the virtual hard drives that are connected to your VM, as the entire state of the virtual hard drive will be reverted as well. This means also that all files that have been created since the snapshot and all other file changes *will be lost.* In order to prevent such data loss while still making use of the snapshot feature, it is possible to add a second hard drive in *write-through* mode using the `VBoxManage` interface and use it to store your data. As write-through hard drives are *not* included in snapshots, they remain unaltered when a machine is reverted. See Special Image Write Modes.

To avoid losing the current state when restoring a snapshot, you can create a new snapshot before the restore operation.

By restoring an earlier snapshot and taking more snapshots from there, it is even possible to create a kind of alternate reality and to switch between these different histories of the virtual machine. This can result in a whole tree of virtual machine snapshots.

3. **Delete a snapshot.** This does not affect the state of the virtual machine, but only releases the files on disk that Oracle VM VirtualBox used to store the snapshot data, thus freeing disk space. To delete a snapshot, select the snapshot name in the Snapshots window and click **Delete** in the toolbar. Snapshots can be deleted even while a machine is running.

> **Note:**
>
> Whereas taking and restoring snapshots are fairly quick operations, deleting a snapshot can take a considerable amount of time since large amounts of data may need to be copied between several disk image files. Temporary disk files may also need large amounts of disk space while the operation is in progress.

There are some situations which cannot be handled while a VM is running, and you will get an appropriate message that you need to perform this snapshot deletion when the VM is shut down.

Snapshot Contents

Think of a snapshot as a point in time that you have preserved. More formally, a snapshot consists of the following:

- The snapshot contains a complete copy of the VM settings, including the hardware configuration, so that when you restore a snapshot, the VM settings are restored as well. For example, if you changed the hard disk configuration or the VM's system settings, that change is undone when you restore the snapshot.

  The copy of the settings is stored in the machine configuration, an XML text file, and thus occupies very little space.

- The complete state of all the virtual disks attached to the machine is preserved. Going back to a snapshot means that all changes that had been made to the machine's disks, file by file and bit by bit, will be undone as well. Files that were since created will disappear, files that were deleted will be restored, changes to files will be reverted.

  Strictly speaking, this is only true for virtual hard disks in "normal" mode. You can configure disks to behave differently with snapshots, see Special Image Write Modes. In technical terms, it is not the virtual disk itself that is restored when a snapshot is restored. Instead, when a snapshot is taken, Oracle VM VirtualBox creates differencing images which contain only the changes since the snapshot were taken. When the snapshot is restored, Oracle VM VirtualBox throws away that differencing image, thus going back to the previous state. This is both faster and uses less disk space. For the details, which can be complex, see Differencing Images.

  Creating the differencing image as such does not occupy much space on the host disk initially, since the differencing image will initially be empty and grow dynamically later with each write operation to the disk. The longer you use the machine after having created the snapshot, however, the more the differencing image will grow in size.

- If you took a snapshot while the machine was running, the memory state of the machine is also saved in the snapshot. This is in the same way that memory can be saved when you close a VM window. When you restore such a snapshot, execution resumes at exactly the point when the snapshot was taken.

  The memory state file can be as large as the memory size of the VM and will therefore occupy considerable disk space.

Virtual Machine Configuration

When you select a virtual machine from the list in the VirtualBox Manager window, you will see a summary of that machine's settings on the right.

Clicking on **Settings** displays a window, where you can configure many of the properties of the selected VM. But be careful when changing VM settings. It is possible to change all VM settings after installing a guest OS, but certain changes might prevent a guest OS from functioning correctly if done after installation.

> **Note:**
>
> The **Settings** button is disabled while a VM is either in the Running or Saved state. This is because the **Settings** window enables you to change fundamental characteristics of the virtual machine that is created for your guest OS. For example, the guest OS may not perform well if half of its memory is taken away. As a result, if the **Settings** button is disabled, shut down the current VM first.

Oracle VM VirtualBox provides a wide range of parameters that can be changed for a virtual machine. The various settings that can be changed in the **Settings** window are described in detail in Configuring Virtual Machines. Even more parameters are available when using the `VBoxManage` command line interface. See VBoxManage.

Removing and Moving Virtual Machines

You can remove a VM from Oracle VM VirtualBox or move the VM and its associated files, such as disk images, to another location on the host.

- **Removing a VM.** To remove a VM, right-click on the VM in the VirtualBox Manager machine list and select **Remove**.

  The confirmation dialog enables you to specify whether to only remove the VM from the list of machines or to remove the files associated with the VM.

  Note that the **Remove** menu item is disabled while a VM is running.

- **Moving a VM.** To move a VM to a new location on the host, right-click on the VM in the VirtualBox Manager's machine list and select **Move**.

  The file dialog prompts you to specify a new location for the VM.

  When you move a VM, Oracle VM VirtualBox configuration files are updated automatically to use the new location on the host.

  Note that the **Move** menu item is disabled while a VM is running.

  You can also use the `VBoxManage movevm` command to move a VM. See VBoxManage movevm.

For information about removing or moving a disk image file from Oracle VM VirtualBox, see The Virtual Media Manager.

Cloning Virtual Machines

You can create a full copy or a linked copy of an existing VM. This copy is called a *clone*. You might use a cloned VM to experiment with a VM configuration, to test different guest OS levels, or to back up a VM.

The **Clone Virtual Machine** wizard guides you through the cloning process.

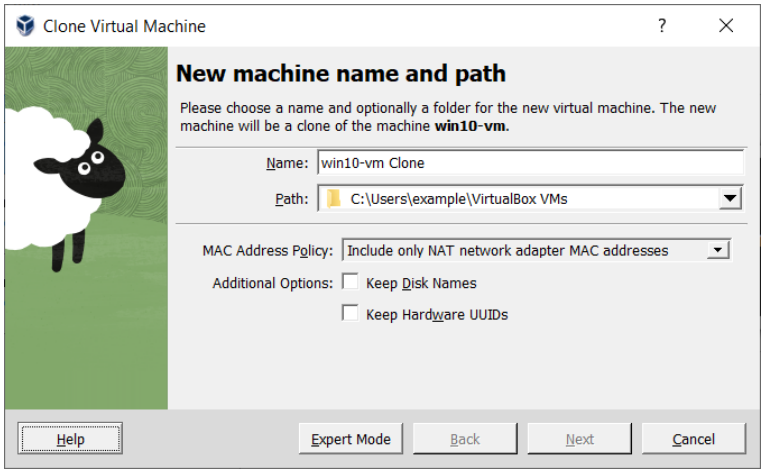
You can start the Clone Virtual Machine wizard in one of the following ways:

- Click the VM name in the machine list and then select **Clone** from the **Machine** menu.
- Click **Clone** in the **Snapshots** window for the selected VM.

> **Note:**
>
> The **Clone** menu item is disabled while a virtual machine is running.

The **New Machine Name and Path** page is displayed.

Figure 1-16 Clone Virtual Machine Wizard: New Machine Name and Path



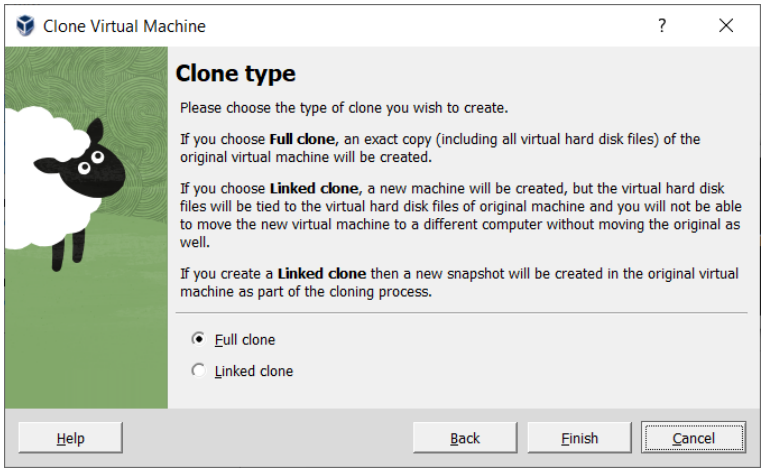
The following clone options are available:

- **Name:** A name for the cloned machine.
- **Path:** Choose a location for the cloned virtual machine, otherwise Oracle VM VirtualBox uses the default machines folder.
- **MAC Address Policy:** Specifies whether to retain network card MAC addresses when cloning the VM.

  For example, the **Generate New MAC Addresses For All Network Adapters** value assigns a new MAC address to each network card during cloning. This is the default setting. This is the best option when both the source VM and the cloned VM must operate on the same network. Other values enable you to retain the existing MAC addresses in the cloned VM.
- **Keep Disk Names:** Retains the disk image names when cloning the VM.
- **Keep Hardware UUIDs:** Retains the hardware universally unique identifiers (UUIDs) when cloning the VM.

Click **Next**. The **Clone Type** page is displayed.

Figure 1-17 Clone Virtual Machine Wizard: Clone Type



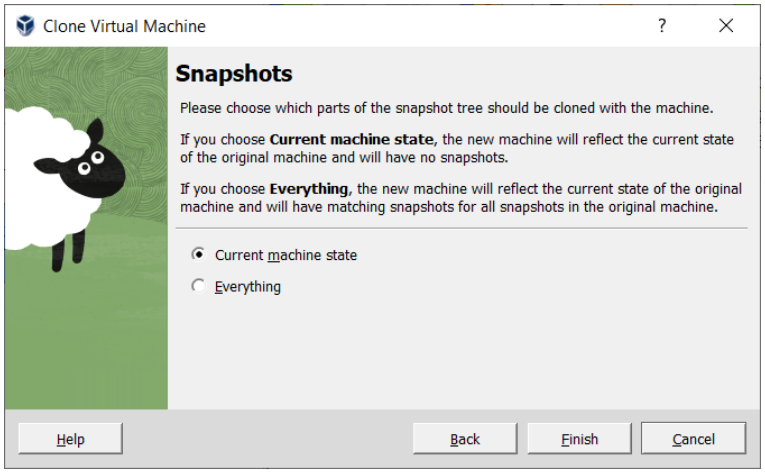
The **Clone Type** option specifies whether to create a clone that is linked to the source VM or to create a fully independent clone:

- **Full Clone:** Copies all dependent disk images to the new VM folder. A full clone can operate fully without the source VM.
- **Linked Clone:** Creates new differencing disk images based on the source VM disk images. If you select the current state of the source VM as the clone point, Oracle VM VirtualBox creates a new snapshot.

(Optional) Click **Next**. The **Snapshots** page is displayed.

> **Note:**
>
> The Snapshots page is only displayed for machines that have snapshots and the selected clone type is **Full Clone**.

Figure 1-18 Clone Virtual Machine Wizard: Snapshots



You use this page to select which parts of the snapshot tree to include in the clone. The available options are as follows:

- **Current Machine State:** Clones the current state of the VM. Snapshots are not included.
- **Everything:** Clones the current machine state and all its snapshots.

Click **Finish** to start the clone operation.

The duration of the clone operation depends on the size and number of attached disk images. In addition, the clone operation saves all the differencing disk images of a snapshot.

You can also use the `VBoxManage clonevm` command to clone a VM. See VBoxManage clonevm.

Importing and Exporting Virtual Machines

Oracle VM VirtualBox can import and export virtual machines in the following formats:

- **Open Virtualization Format (OVF).** This is the industry-standard format. See About the OVF Format.
- **Cloud service formats.** Export to and import from cloud services such as Oracle Cloud Infrastructure is supported. See Integrating with Oracle Cloud Infrastructure.

About the OVF Format

OVF is a cross-platform standard supported by many virtualization products which enables the creation of ready-made virtual machines that can then be imported into a hypervisor such as Oracle VM VirtualBox. Oracle VM VirtualBox makes OVF import and export easy to do, using VirtualBox Manager or the command-line interface.

Using OVF enables packaging of *virtual appliances*. These are disk images, together with configuration settings that can be distributed easily. This way one can offer complete ready-to-use software packages, including OSes with applications, that need no configuration or installation except for importing into Oracle VM VirtualBox.

> **Note:**
>
> The OVF standard is complex, and support in Oracle VM VirtualBox is an ongoing process. In particular, no guarantee is made that Oracle VM VirtualBox supports all appliances created by other virtualization software. For a list of known limitations, see Known Limitations.

Appliances in OVF format can appear in the following variants:

- They can come in several files, as one or several disk images, typically in the widely-used VMDK format. See Disk Image Files (VDI, VMDK, VHD, HDD). They also include a textual description file in an XML dialect with an `.ovf` extension. These files must then reside in the same directory for Oracle VM VirtualBox to be able to import them.
- Alternatively, the above files can be packed together into a single archive file, typically with an `.ova` extension. Such archive files use a variant of the TAR archive format and can therefore be unpacked outside of Oracle VM VirtualBox with any utility that can unpack standard TAR files.

> **Note:**
>
> OVF cannot describe snapshots that were taken for a virtual machine. As a result, when you export a virtual machine that has snapshots, only the current state of the machine will be exported. The disk images in the export will have a *flattened* state identical to the current state of the virtual machine.

Importing an Appliance in OVF Format

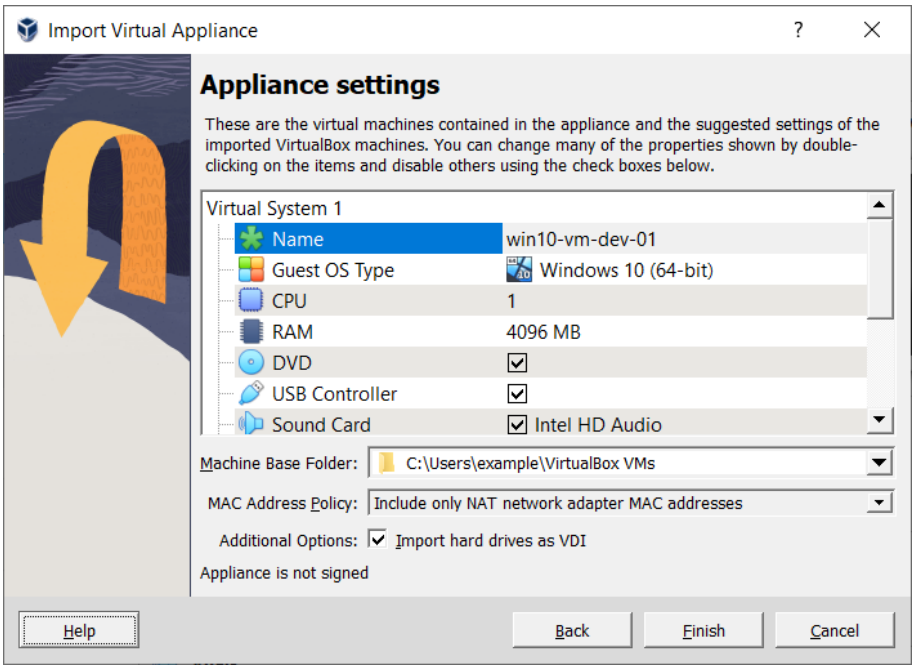
The following steps show how to import an appliance in OVF format.

1. Double-click on the OVF or OVA file.

   Oracle VM VirtualBox creates file type associations automatically for any OVF and OVA files on your host OS.

   The **Appliance Settings** page of the **Import Virtual Appliance** wizard is shown.

Figure 1-19 Import Virtual Appliance Wizard: Appliance Settings



2. The **Appliance Settings** page shows the VMs described in the OVF or OVA file and enables you to change the VM settings.

   By default, membership of VM groups is preserved on import for VMs that were initially exported from Oracle VM VirtualBox. You can change this behavior by using the **Primary Group** setting for the VM.

   The following global settings apply to all of the VMs that you import:

   - **Base Folder:** Specifies the directory on the host in which to store the imported VMs.

     If an appliance has multiple VMs, you can specify a different directory for each VM by editing the **Base Folder** setting for the VM.

- **MAC Address Policy:** Reinitializes the MAC addresses of network cards in your VMs prior to import, by default. You can override the default behavior and preserve the MAC addresses on import.
- **Import Hard Drives as VDI:** Imports hard drives in the VDI format rather than in the default VMDK format.

3. Click **Finish** to import the appliance.

   Oracle VM VirtualBox copies the disk images and creates local VMs with the settings described on the **Appliance Settings** page. The imported VMs are shown in the list of VMs in VirtualBox Manager.

   Because disk images are large, the VMDK images that are included with virtual appliances are shipped in a compressed format that cannot be used directly by VMs. So, the images are first unpacked and copied, which might take several minutes.

You can use the `VBoxManage import` command to import an appliance. See VBoxManage import.

Exporting an Appliance in OVF Format

The following steps show how to export an appliance in OVF format.

1. Select **File**, **Export Appliance** to display the **Export Virtual Appliance** wizard.

   On the initial **Virtual Machines** page, you can combine several VMs into an OVF appliance.

   Select one or more VMs to export, and click **Next**.

2. The **Format Settings** page enables you to configure the following settings:
   - **Format:** Selects the **Open Virtualization Format** value for the output files.

     The **Oracle Cloud Infrastructure** value exports the appliance to Oracle Cloud Infrastructure. See Exporting an Appliance to Oracle Cloud Infrastructure.
   - **File:** Selects the location in which to store the exported files.
   - **MAC Address Policy:** Specifies whether to retain or reassign network card MAC addresses on export.
   - **Write Manifest File:** Enables you to include a manifest file in the exported archive file.
   - **Include ISO Image Files:** Enables you to include ISO image files in the exported archive file.
3. Click **Next** to show the **Appliance Settings** page.

   You can edit settings for the virtual appliance. For example, you can change the name of the virtual appliance or add product information, such as vendor details or license text.

   Double-click the appropriate field to change its value.
4. Click **Finish** to begin the export process. Note that this operation might take several minutes.

You can use the `VBoxManage export` command to export an appliance. See VBoxManage export.

Integrating with Oracle Cloud Infrastructure

This section describes how to use the features of Oracle VM VirtualBox to integrate with Oracle Cloud Infrastructure.

Integrating with Oracle Cloud Infrastructure involves the following steps:

- **Prepare for Oracle Cloud Infrastructure Integration.** Before using Oracle VM VirtualBox with Oracle Cloud Infrastructure there are some initial configuration steps you may need to do. See Preparing for Oracle Cloud Infrastructure Integration.
- **Use Oracle VM VirtualBox with Oracle Cloud Infrastructure.**Using Oracle VM VirtualBox With Oracle Cloud Infrastructure describes how you can use Oracle VM VirtualBox with Oracle Cloud Infrastructure.

Preparing for Oracle Cloud Infrastructure Integration

Perform the following configuration steps before using Oracle VM VirtualBox to integrate with your Oracle Cloud Infrastructure account.

1. **Install the Extension Pack.** Cloud integration features are only available when you install the Oracle VM VirtualBox Extension Pack. See Installing Oracle VM VirtualBox and Extension Packs.
2. **Create a key pair.** Generate an API signing key pair that is used for API requests to Oracle Cloud Infrastructure. See Creating an API Signing Key Pair.

   Upload the public key of the key pair from your client device to the cloud service. See Uploading the Public Key to Oracle Cloud Infrastructure.
3. **Create a cloud profile.** The cloud profile contains resource identifiers for your cloud account, such as your user OCID, and details of your key pair. See Creating a Cloud Profile.

Creating an API Signing Key Pair

To use the cloud integration features of Oracle VM VirtualBox, you must generate an API signing key pair that is used for API requests to Oracle Cloud Infrastructure.

Your API requests are signed with your private key, and Oracle Cloud Infrastructure uses the public key to verify the authenticity of the request. You must upload the public key to the Oracle Cloud Infrastructure Console.

> **Note:**
>
> This key pair is not the same SSH key that you use to access compute instances on Oracle Cloud Infrastructure.

1. (Optional) Create a `.oci` directory to store the key pair.

   ```
   $ mkdir ~/.oci
   ```

   The key pair is usually installed in the `.oci` folder in your home directory. For example, `~/.oci` on a Linux system.
2. Generate the private key.

   Use the `openssl` command.

   - To generate a private key with a passphrase:

     ```
     $ openssl genrsa -out ~/.oci/oci_api_key.pem -aes128 2048
     ```

- To generate a private key without a passphrase:

```
$ openssl genrsa -out ~/.oci/oci_api_key.pem 2048
```

3. Change permissions for the private key.

```
$ chmod 600 ~/.oci/oci_api_key.pem
```

Generate the public key.

```
$ openssl rsa -pubout -in ~/.oci/oci_api_key.pem -out ~/.oci/oci_api_key_public.pem
```

Uploading the Public Key to Oracle Cloud Infrastructure

Use the following steps to upload your public key to Oracle Cloud Infrastructure.

1. Log in to the Oracle Cloud Infrastructure Console.
2. Display the **User Settings** page.

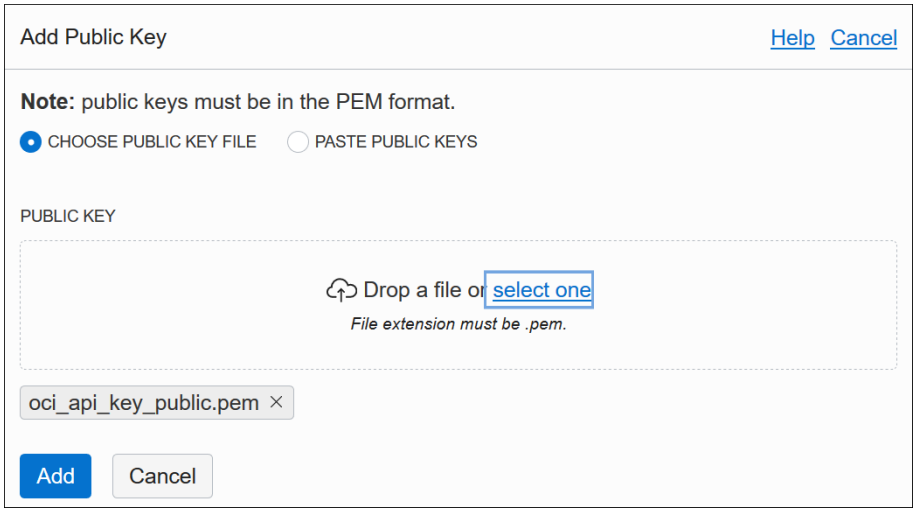
   Click **Profile**, **User Settings**.
3. Display your current API signing keys.

   Click **Resources**, **API Keys**.
4. Upload the public key.

   Click **Add Public Key**.

   The **Add Public Key** dialog is displayed.

Figure 1-20 Upload Public Key Dialog in Oracle Cloud Infrastructure Console



Select one of the following options:

- **Choose Public Key File.** This option enables you to browse to the public key file on your local hard disk.
- **Paste Public Keys.** This option enables you to paste the contents of the public key file into the window in the dialog box.

Click **Add** to upload the public key.

Creating a Cloud Profile

Oracle VM VirtualBox uses a *cloud profile* to connect to Oracle Cloud Infrastructure. A cloud profile is a text file that contains details of your key files and Oracle Cloud Identifier (OCID) resource identifiers for your cloud account, such as the following:

- **Fingerprint of the public key.** To obtain the fingerprint, you can use the `openssl` command:

  ```
  $ openssl rsa -pubout -outform DER -in ~/.oci/oci_api_key.pem | openssl md5 -c
  ```

- **Location of the private key on the client device.** Specify the full path to the private key.
- **(Optional) Passphrase for the private key.** This is only required if the key is encrypted.
- **Region**. Shown on the Oracle Cloud Infrastructure Console. Click **Administration**, **Tenancy Details**.
- **Tenancy OCID.** Shown on the Oracle Cloud Infrastructure Console. Click **Administration**, **Tenancy Details**.

  A link enables you to copy the Tenancy OCID.
- **Compartment OCID.** Shown on the Oracle Cloud Infrastructure Console. Click **Identity**, **Compartments**.

  A link enables you to copy the Compartment OCID.
- **User OCID.** Shown on the Oracle Cloud Infrastructure Console. Click **Profile**, **User Settings**.

  A link enables you to copy the User OCID.

You can create a cloud profile in the following ways:

- Automatically, by using the **Cloud Profile Manager**. See Using the Cloud Profile Manager.

  The Cloud Profile Manager is a VirtualBox Manager tool that enables you to create, edit, and manage cloud profiles for your cloud service accounts.
- Automatically, by using the `VBoxManage cloudprofile` command. See VBoxManage cloudprofile.
- Manually, by creating an `oci_config` file in your Oracle VM VirtualBox global configuration directory. For example, this is `$HOME/.config/VirtualBox/oci_config` on a Linux host.
- Manually, by creating a `config` file in your Oracle Cloud Infrastructure configuration directory. For example, this is `$HOME/.oci/config` on a Linux host.

  This is the same file that is used by the Oracle Cloud Infrastructure command line interface.

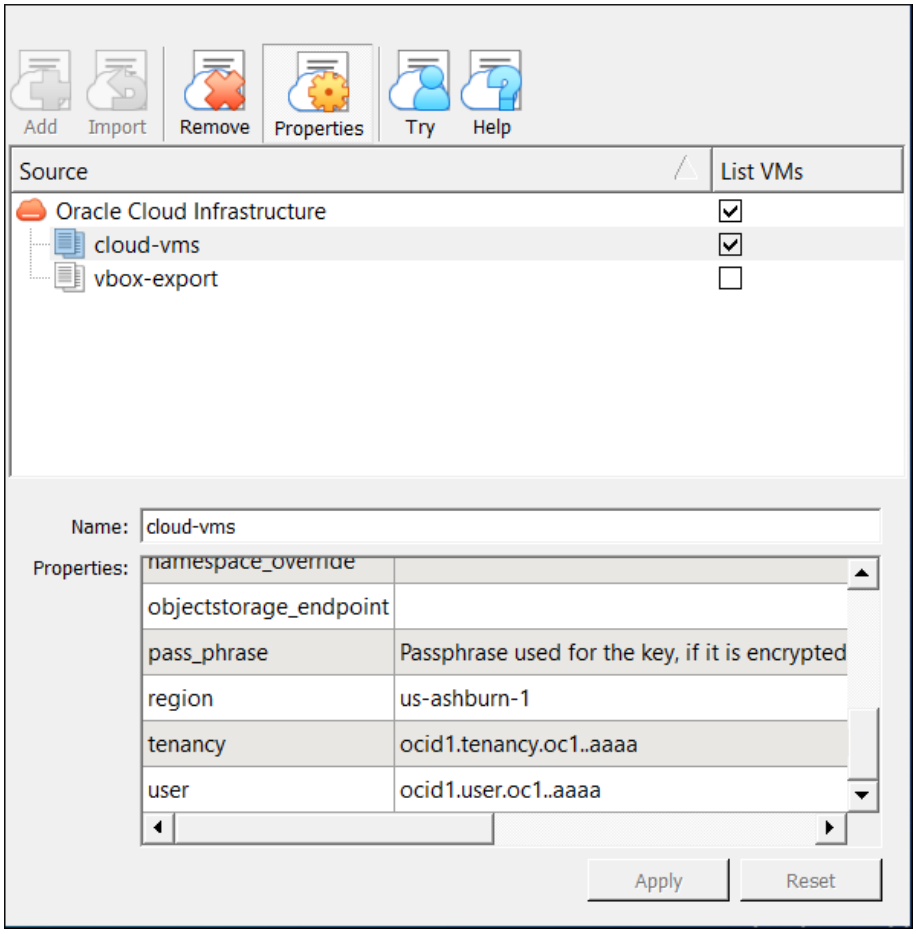
  Oracle VM VirtualBox automatically uses the `config` file if no cloud profile file is present in your global configuration directory. Alternatively, you can import this file manually into the Cloud Profile Manager.

Using the Cloud Profile Manager

This section describes how to use the Cloud Profile Manager to create a cloud profile.

To open the Cloud Profile Manager click **File**, **Cloud Profile Manager** in VirtualBox Manager.

Figure 1-21 The Cloud Profile Manager



You can use the Cloud Profile Manager in the following ways:

- To create a new cloud profile automatically
- To create a cloud profile by importing settings from your Oracle Cloud Infrastructure configuration file.

Perform the following steps to create a new cloud profile automatically, using the Cloud Profile Manager:

1. Click the **Add** icon and specify a **Name** for the profile.
2. Click **Properties** and specify the following property values for the profile:
   - Compartment OCID
   - Fingerprint of the public key
   - Location of the private key on the client device
   - Region OCID
   - Tenancy OCID
   - User OCID

   Some of these are settings for your Oracle Cloud Infrastructure account, which you can view from the Oracle Cloud Infrastructure Console.

3. (Optional) If you are using the cloud profile to connect to cloud virtual machines, select the **Show VMs** check box.

   This creates a new subgroup of the **OCI** group in VirtualBox Manager. See About the OCI VM Group.

4. Click **Apply** to save your changes.

   The cloud profile settings are saved to the `oci_config` file in your Oracle VM VirtualBox global settings directory.

Perform the following steps to import an existing Oracle Cloud Infrastructure configuration file into the Cloud Profile Manager:

1. Ensure that a `config` file is present in your Oracle Cloud Infrastructure configuration directory. For example, this is `$HOME/.oci/config` on a Linux host.
2. Click the **Import** icon to open a dialog that prompts you to import cloud profiles from external files.

   > **Note:**
   >
   > This action overwrites any cloud profiles that are in your Oracle VM VirtualBox global settings directory.

3. Click **Import**.

   Your cloud profile settings are saved to the `oci_config` file in your Oracle VM VirtualBox global settings directory.

4. Click **Properties** to show the cloud profile settings.

   Double-click on the appropriate field to change the value.

5. Click **Apply** to save your changes.

Using Oracle VM VirtualBox With Oracle Cloud Infrastructure

This section describes how you can use Oracle VM VirtualBox with Oracle Cloud Infrastructure to do the following tasks:

- Create, add, and manage Oracle Cloud Infrastructure cloud instances using VirtualBox Manager. See Using Cloud Virtual Machines.
- Export an Oracle VM VirtualBox VM to Oracle Cloud Infrastructure. See Exporting an Appliance to Oracle Cloud Infrastructure.
- Import a cloud instance into Oracle VM VirtualBox. See Importing an Instance from Oracle Cloud Infrastructure.
- Connect from a local VM to an Oracle Cloud Infrastructure cloud subnet. See Using a Cloud Network.
- Use the `VBoxManage` commands to integrate with Oracle Cloud Infrastructure and perform cloud operations. See Using VBoxManage Commands With Oracle Cloud Infrastructure.

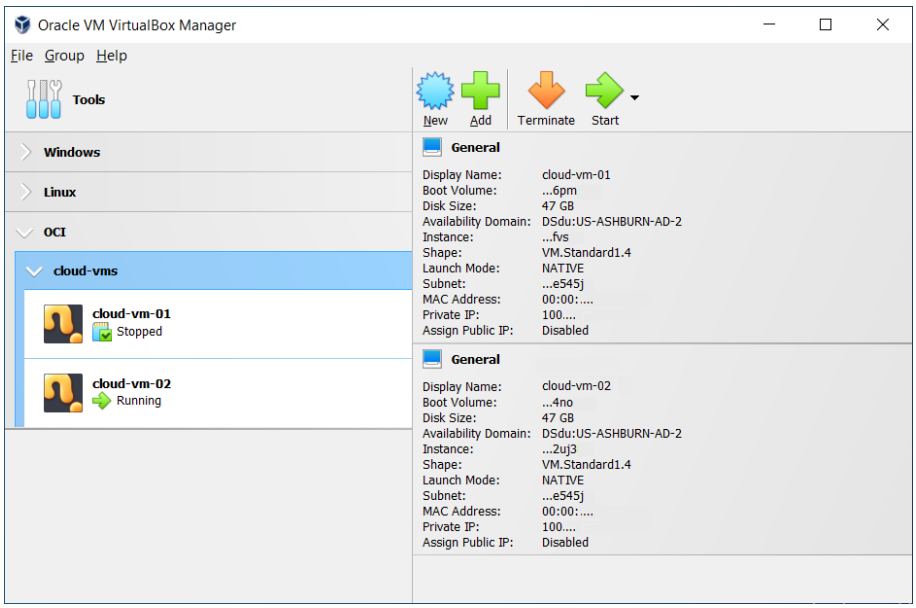
Using Cloud Virtual Machines

A cloud virtual machine (*cloud VM*) is a type of VM that represents an instance on a cloud service. Cloud VMs are shown in the machine list in VirtualBox Manager, in the same way as local VMs are.

By using cloud VMs you can create, manage, and control your Oracle Cloud Infrastructure instances from VirtualBox Manager.

> **Note:**
>
> Cloud VMs do not install, export, or import instances to the Oracle VM VirtualBox host. All operations are done remotely on the cloud service.

Figure 1-22 Cloud VMs, Shown in VirtualBox Manager



Cloud VMs can be used to do the following tasks in Oracle Cloud Infrastructure:

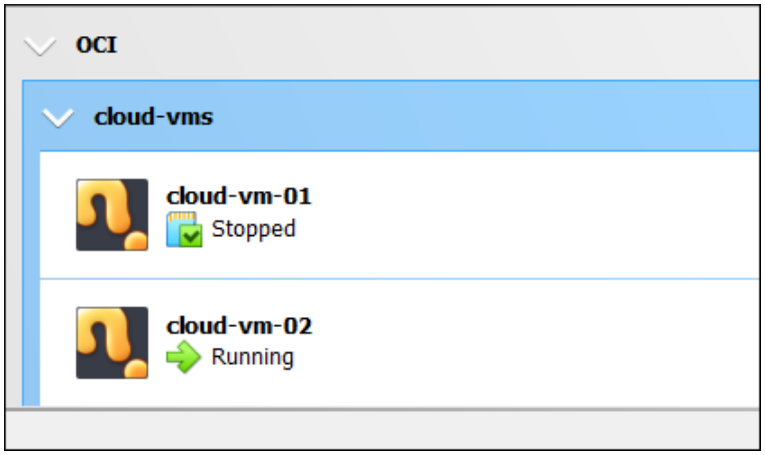
- **Create a new Oracle Cloud Infrastructure instance.** See Creating a New Cloud VM.
- **Use an existing Oracle Cloud Infrastructure instance.** See Adding a Cloud VM.
- **Configure an Oracle Cloud Infrastructure instance.** You can change settings for the instance, such as display name and shape. See Changing Settings for a Cloud VM.
- **Control an Oracle Cloud Infrastructure instance.** Stop, start, and terminate the instance. See Controlling a Cloud VM
- **Create a console connection to an Oracle Cloud Infrastructure instance**. See Creating an Instance Console Connection for a Cloud VM.

About the OCI VM Group

All cloud VMs are shown in the machine list in VirtualBox Manager, in a special VM group called **OCI**.

Cloud VMs are further grouped according to the cloud profile used to connect to them. The cloud profile identifies the user and compartment for the cloud VM and includes details of the key pair used to connect to cloud instances. See Creating a Cloud Profile.

Figure 1-23 OCI Group, Containing Cloud VMs



All cloud profiles registered with Oracle VM VirtualBox are listed automatically in the OCI group.

To enable or disable listing of cloud VMs in VirtualBox Manager for a specific cloud profile, do the following:

Display the **Cloud Profile Manager** and select or deselect the **List VMs** check box for each cloud profile.

Creating a New Cloud VM

When you create a new cloud VM, a *new* Oracle Cloud Infrastructure instance is created and associated with the cloud VM.

Perform the following steps to create a new cloud VM:

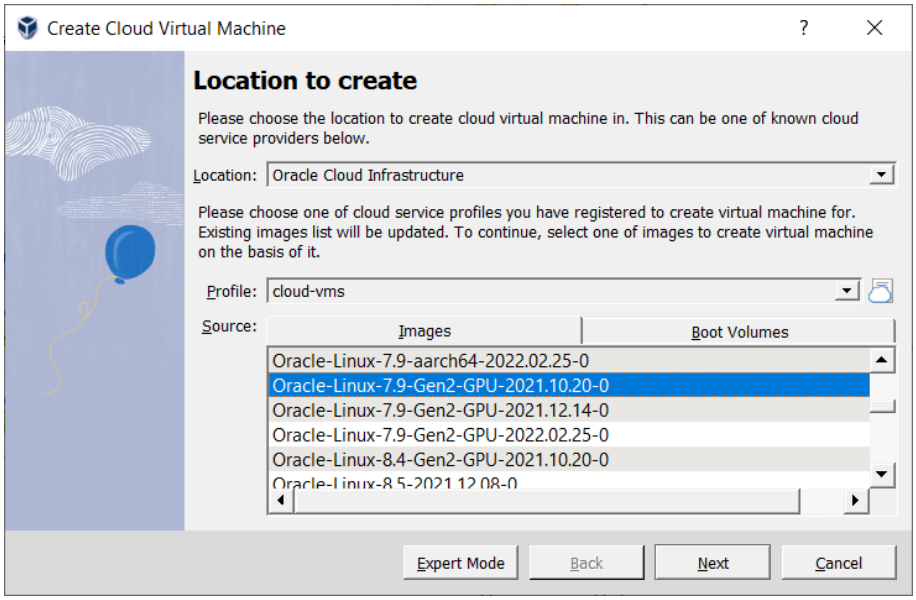
1. Click on a cloud profile in the **OCI** group.

   The cloud VMs for the selected cloud profile are displayed.

2. Select **Group**, **New Machine**.

   The **Create Cloud Virtual Machine** wizard is displayed.

Figure 1-24 Create Cloud Virtual Machine Wizard



3. On the initial page, configure the following settings for the new cloud VM:
   - **Location:** The cloud service provider that will host the new instance. Select **Oracle Cloud Infrastructure**.
   - **Profile:** The cloud profile used to connect to the new instance. Select from the available cloud profiles.
   - **Source:** The image that the new instance is based on. Choose from the available images and boot volumes.
4. Click **Next** to display the **Cloud Virtual Machine Settings** page.

   You can use this page to change the default settings for the new Oracle Cloud Infrastructure instance, such as the display name, shape, and networking configuration.

   To add an SSH key to the instance, click the **SSH Authorised Keys** field and paste the public key into the displayed dialog.
5. Click **Finish** to create a new Oracle Cloud Infrastructure instance using the selected image or boot volume. The new instance is started automatically.

   The new cloud VM is shown in the **OCI** group in VirtualBox Manager.

Adding a Cloud VM

When you add a cloud VM, an *existing* Oracle Cloud Infrastructure instance is associated with the cloud VM. You can only add one cloud VM for each instance.

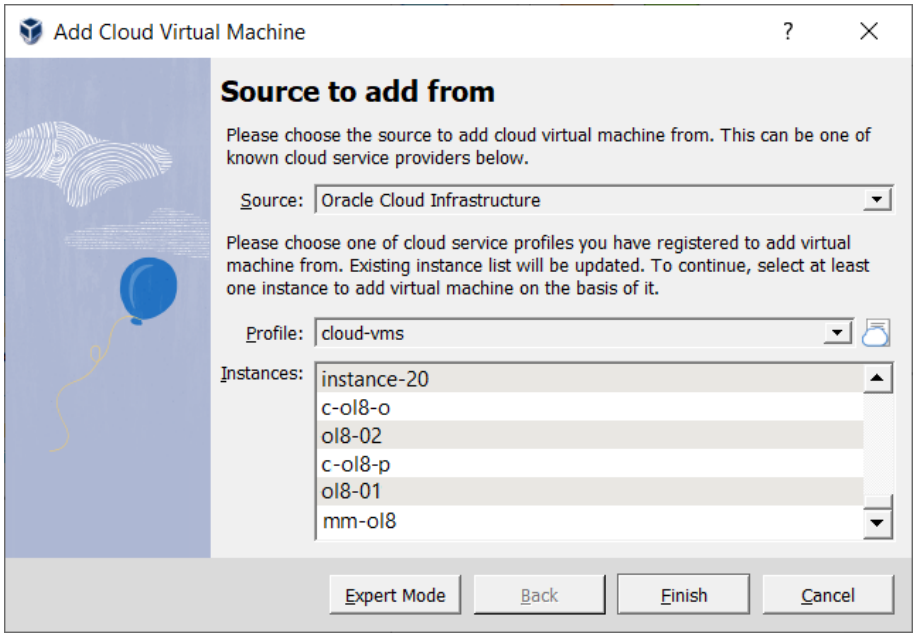
Perform the following steps to add a cloud VM:

1. Click on a cloud profile in the **OCI** group.

   The cloud VMs for the selected cloud profile are displayed.
2. Select **Group**, **Add Machine**.

   The **Add Cloud Virtual Machine** wizard is displayed.

Figure 1-25 Add Cloud Virtual Machine Wizard



3. Configure the following settings:
   - **Source:** The cloud service provider that hosts the instance used for the cloud VM. Select **Oracle Cloud Infrastructure**.
   - **Profile:** The cloud profile used to connect to the running instance. Select from the available cloud profiles.
   - **Instances:** The instance to use for the cloud VM. Choose from the available instances on your cloud service.
4. Click **Finish** to add a cloud VM based on the selected instance.

   A cloud VM with the same name as the instance is added to the **OCI** group in VirtualBox Manager.
5. (Optional) To change the display name for the instance, click **Settings** and edit the **Display Name** field.

   The cloud VM name in VirtualBox Manager is updated automatically.

Changing Settings for a Cloud VM

Select the cloud VM in VirtualBox Manager and click **Settings**.

- For a *new* cloud VM, you can change many settings for the Oracle Cloud Infrastructure instance, such as the display name, shape, and disk size.
- When you *add* a cloud VM based on an existing Oracle Cloud Infrastructure instance you can only change the display name.

Controlling a Cloud VM

You can use VirtualBox Manager to control a cloud VM as follows:

- **Start.** Use the **Start** button in the VirtualBox Manager toolbar.

- **Stop.** Right-click on the cloud VM name, to display the **Close** menu. Options to shut down and power off the cloud VM are available.
- **Terminate.** Use the **Terminate** button in the VirtualBox Manager toolbar.

> **Caution:**
>
> This action deletes the instance from Oracle Cloud Infrastructure.

When you control a cloud VM in VirtualBox Manager the machine list is updated automatically with the current instance state, such as **Stopped** or **Running**.

When you control an instance using the Oracle Cloud Infrastructure console, VirtualBox Manager updates the status for the corresponding cloud VM automatically.

Removing a Cloud VM

You can use VirtualBox Manager to remove a cloud VM as follows:

Right-click on the cloud VM name and select **Remove**.

- Click **Remove Only** to remove the cloud VM from the machine list in VirtualBox Manager.
- Click **Delete Everything** to remove the cloud VM from VirtualBox Manager and also to delete the Oracle Cloud Infrastructure instance and any associated boot volumes.

Creating an Instance Console Connection for a Cloud VM

To create a instance console connection, the cloud VM must be in **Running** state.

1. Right-click on the cloud VM name and select **Console**, **Create Connection**.
2. The **Public Key** dialog is displayed. Paste the public key used for the instance connection into the dialog and click **OK**.

   By default, either the first entry in your SSH keys folder or the public key used for your previous instance console connection is used.
3. Click **Connect** to connect to the instance. An instance console is displayed automatically on the host.
4. (Optional) Click **Show Log** to display log messages for the instance console connection.

See the Oracle Cloud Infrastructure documentation for details about how you can use an instance console connection to troubleshoot instance problems.

Exporting an Appliance to Oracle Cloud Infrastructure

Oracle VM VirtualBox supports the export of VMs to an Oracle Cloud Infrastructure service. The exported VM is stored on Oracle Cloud Infrastructure as a custom Linux image. You can configure whether a cloud instance is created and started after the export process has completed.

> **Note:**
>
> Before you export a VM to Oracle Cloud Infrastructure, you must prepare the VM as described in Preparing a VM for Export to Oracle Cloud Infrastructure.

Use the following steps to export a VM to Oracle Cloud Infrastructure:

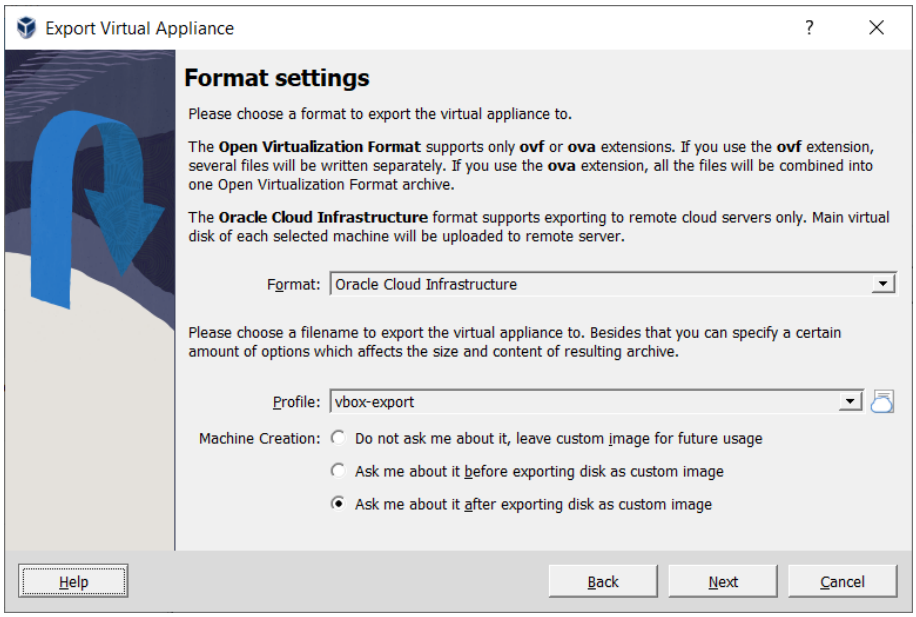
1. Select **File**, **Export Appliance** to open the **Export Virtual Appliance** wizard.

   Select a VM to export and click **Next** to display the **Format Settings** page.

2. From the **Format** drop-down list, select **Oracle Cloud Infrastructure**.

   In the **Profile** drop-down list, select the cloud profile used for your Oracle Cloud Infrastructure account.

Figure 1-26 Export Virtual Appliance Wizard: Format Settings



In the **Machine Creation** field, select an option to configure settings for the cloud instance created when you export to Oracle Cloud Infrastructure. The options enable you to do one of the following:

- Configure settings for the cloud instance *after* you have finished exporting the VM.
- Configure settings for the cloud instance *before* you start to export the VM.
- Do not create a cloud instance when you export the VM.

Click **Next** to make an API request to the Oracle Cloud Infrastructure service and open the **Appliance Settings** page.

3. (Optional) Edit storage settings used for the exported virtual machine in Oracle Cloud Infrastructure. You can change the following settings:

   - The name of the bucket used to store the exported files.

- Whether to store the custom image in Oracle Cloud Infrastructure.
- The display name for the custom image in Oracle Cloud Infrastructure.
- The launch mode for the custom image.

  Paravirtualized mode gives improved performance and should be suitable for most Oracle VM VirtualBox VMs.

  Emulated mode is suitable for legacy OS images.

Click **Finish** to continue.

4. (Optional) Depending on the selection in the **Machine Creation** field, the **Appliance Settings** page may be displayed before or after export. This screen enables you to configure settings for the cloud instance, such as Shape and Disk Size.

   Click **Finish**. The VM is exported to Oracle Cloud Infrastructure.

   Depending on the **Machine Creation** setting, a cloud instance may be started after upload to Oracle Cloud Infrastructure is completed.

5. Monitor the export process by using the Oracle Cloud Infrastructure Console.

You can also use the `VBoxManage export` command to export a VM to Oracle Cloud Infrastructure. See VBoxManage export.

Preparing a VM for Export to Oracle Cloud Infrastructure

Oracle Cloud Infrastructure provides the option to import a custom Linux image. Before an Oracle VM VirtualBox image can be exported to Oracle Cloud Infrastructure, the custom image needs to be prepared to ensure that instances launched from the custom image can boot correctly and that network connections will work. This section provides advice on how to prepare a Linux image for export from Oracle VM VirtualBox.

The following list shows some tasks to consider when preparing an Oracle Linux VM for export:

- **Use DHCP for network addresses.** Configure the VM to use a DHCP server to allocate network addresses, rather than using a static IP address. The Oracle Cloud Infrastructure instance will then be allocated an IP address automatically.
- **Do not specify a MAC address.** The network interface configuration for the VM must not specify the MAC address.

  Remove the HWADDR setting from the `/etc/sysconfig/ifcfg-`*`devicename`* network script.
- **Disable persistent network device naming rules.** This means that the Oracle Cloud Infrastructure instance will use the same network device names as the VM.

  1. Change the GRUB kernel parameters.

     Add `net.ifnames=0` and `biosdevname=0` as kernel parameter values to the `GRUB_CMDLINE_LINUX` variable.

  2. Update the GRUB configuration.

     ```
     # grub2-mkconfig -o /boot/grub2/grub.cfg
     ```

  3. Disable any `udev` rules for network device naming.

     For example, if an automated `udev` rule exists for `net-persistence`:

     ```
     # cd /etc/udev/rules.d
     # rm -f 70-persistent-net.rules
     # ln -s /dev/null /etc/udev/rules.d/70-persistent-net.rules
     ```

- **Enable the serial console.** This enables you to troubleshoot the instance when it is running on Oracle Cloud Infrastructure.

  1. Edit the `/etc/default/grub` file, as follows:

     – Remove the `resume` setting from the kernel parameters. This setting slows down boot time significantly.

     – Replace `GRUB_TERMINAL="gfxterm"` with `GRUB_TERMINAL="console serial"`. This configures use of the serial console instead of a graphical terminal.

     – Add `GRUB_SERIAL_COMMAND="serial --unit=0 --speed=115200"`. This configures the serial connection.

     – Add `console=tty0 console=ttyS0,115200` to the `GRUB_CMDLINE_LINUX` variable. This adds the serial console to the Linux kernel boot parameters.

  2. Regenerate the GRUB configuration.

     ```
     # grub2-mkconfig -o /boot/grub2/grub.cfg
     ```

  3. To verify the changes, reboot the machine and run the `dmesg` command to look for the updated kernel parameters.

     ```
     # dmesg |grep console=ttyS0
     ```

- **Enable paravirtualized device support.** You do this by adding the `virtio` drivers to the `initrd` for the VM.

  1. This procedure works only on machines with a Linux kernel of version 3.4 or later. Check that the VM is running a supported kernel:

     ```
     # uname -a
     ```

  2. Use the `dracut` tool to rebuild `initrd`. Add the `qemu` module, as follows:

     ```
     # dracut --logfile /var/log/Dracut.log --force --add qemu
     ```

  3. Verify that the `virtio` drivers are now present in `initrd`.

     ```
      # lsinitrd |grep virtio
     ```

For more information about importing a custom Linux image into Oracle Cloud Infrastructure, see also:

https://docs.cloud.oracle.com/iaas/Content/Compute/Tasks/importingcustomimagelinux.htm

Importing an Instance from Oracle Cloud Infrastructure

Perform the following steps to import a cloud instance from Oracle Cloud Infrastructure into Oracle VM VirtualBox:

1. Select **File**, **Import Appliance** to open the **Import Virtual Appliance** wizard.

   In the **Source** drop-down list, select **Oracle Cloud Infrastructure**.

   In the **Profile** drop-down list, select the cloud profile for your Oracle Cloud Infrastructure account.

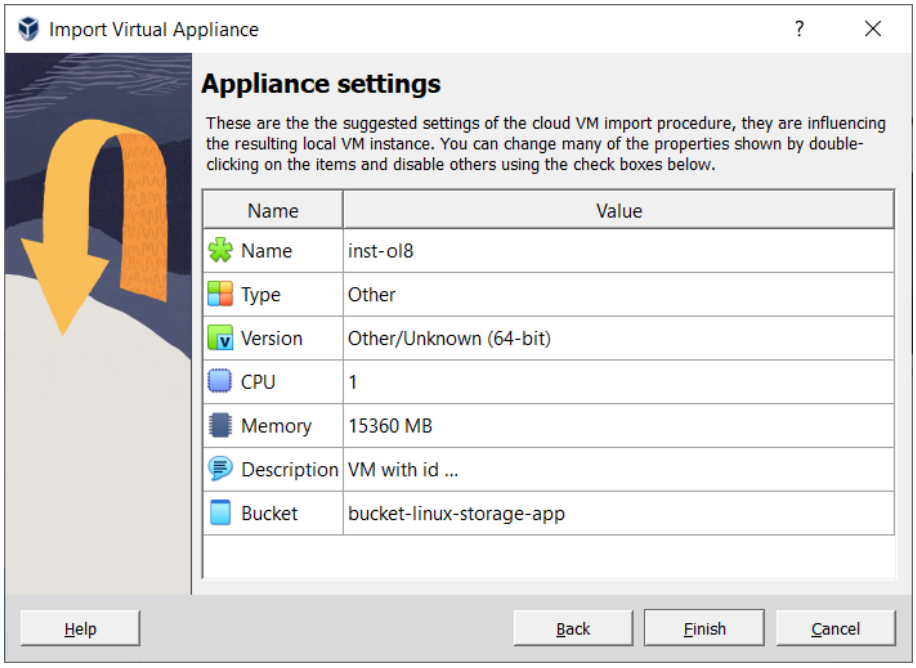
   Choose the required cloud instance from the list in the **Machines** field.

   Click **Next** to make an API request to the Oracle Cloud Infrastructure service and display the **Appliance Settings** page.

2. (Optional) Edit settings for the new local virtual machine.

   For example, you can edit the VM name and description.

Figure 1-27 Import Cloud Instance Wizard: Appliance Settings



Click **Finish** to import the instance from Oracle Cloud Infrastructure.

3. Monitor the import process by using the Oracle Cloud Infrastructure Console.

You can also use the `VBoxManage import` command to import an instance from Oracle Cloud Infrastructure. See VBoxManage import.

Importing an Instance: Overview of Events

The following describes the sequence of events when you import an instance from Oracle Cloud Infrastructure.

- A custom image is created from the boot volume of the instance.
- The custom image is exported to an Oracle Cloud Infrastructure object and is stored using Object Storage in the bucket specified by the user.
- The Oracle Cloud Infrastructure object is downloaded to the local host. The object is a TAR archive which contains a boot volume of the instance in QCOW2 format and a JSON file containing metadata related to the instance.
- The boot volume of the instance is extracted from the archive and a new VMDK image is created by converting the boot volume into the VMDK format. The VMDK image is registered with Oracle VM VirtualBox.
- A new VM is created using the VMDK image for the cloud instance.

  By default, the new VM is not started after import from Oracle Cloud Infrastructure.
- The downloaded TAR archive is deleted after a successful import.

Using a Cloud Network

A cloud network is a type of network that can be used for connections from a local VM to a remote Oracle Cloud Infrastructure cloud instance.

To create and use a cloud network, do the following:

1. Set up a virtual cloud network on Oracle Cloud Infrastructure.

   The following steps create and configure a virtual cloud network (VCN) on Oracle Cloud Infrastructure. The VCN is used to tunnel network traffic across the cloud.

   a. Ensure that you have a cloud profile for connecting to Oracle Cloud Infrastructure. See Creating a Cloud Profile.

   b. Run the following `VBoxManage cloud` command:

      ```
      VBoxManage cloud --provider="OCI" --profile="vbox-oci" network setup
      ```

      where `vbox-oci` is the name of your cloud profile.

      Other options are available for the `VBoxManage cloud network setup` command, to enable you to configure details for the VCN. For example, you can configure the operating system used for the cloud gateway instance and the IP address range used by the tunneling network. See VBoxManage cloud.

      For best results, use an Oracle Linux 7 instance for the cloud gateway. This is the default option.

2. Register the new cloud network with Oracle VM VirtualBox.

   Use the **Cloud Networks** tab in the **Network Manager** tool. See Cloud Networks Tab.

3. Add cloud network adaptors to the local VMs that will use the cloud network. See Cloud Networks.

Using VBoxManage Commands With Oracle Cloud Infrastructure

This section includes some examples of how `VBoxManage` commands can be used to integrate with Oracle Cloud Infrastructure and perform common cloud operations.

Creating a Cloud Profile

To create a cloud profile called `vbox-oci`:

```
VBoxManage cloudprofile --provider "OCI" --profile="vbox-oci" add \
--clouduser="ocid1.user.oc1..."  --keyfile="/home/username/.oci/oci_api_key.pem" \
--tenancy="ocid1.tenancy.oc1..."  --compartment="ocid1.compartment.oc1..."  --region="us-
ashburn-1"
```

The new cloud profile is added to the `oci_config` file in your Oracle VM VirtualBox global configuration directory. For example, this is `$HOME/.VirtualBox/oci_config` on a Windows host.

Listing Cloud Instances

To list the instances in your Oracle Cloud Infrastructure compartment:

```
VBoxManage cloud --provider="OCI" --profile="vbox-oci" list instances
```

Exporting an Oracle VM VirtualBox VM to the Cloud

To export a VM called `myVM` and create a cloud instance called `myVM_Cloud`:

```
VBoxManage export myVM --output OCI:// --cloud 0 --vmname myVM_Cloud \
--cloudprofile "vbox-oci" --cloudbucket myBucket \
--cloudshape VM.Standard2.1 --clouddomain US-ASHBURN-AD-1 --clouddisksize 50  \
--cloudocivcn ocid1.vcn.oc1... --cloudocisubnet ocid1.subnet.oc1... \
```

```
--cloudkeepobject true --cloudlaunchinstance true --cloudpublicip true
```

Importing a Cloud Instance Into Oracle VM VirtualBox

To import a cloud instance and create an Oracle VM VirtualBox VM called `oci_Import`:

```
VBoxManage import OCI:// --cloud --vmname oci_Import --memory 4000
--cpus 3 --ostype FreeBSD_64 --cloudprofile "vbox-oci"
--cloudinstanceid ocid1.instance.oc1... --cloudbucket myBucket
```

Creating a New Cloud Instance From a Custom Image

To create a new cloud instance from a custom image on Oracle Cloud Infrastructure:

```
VBoxManage cloud --provider="OCI" --profile="vbox-oci" instance create \
--domain-name="oraclecloud.com" --image-id="ocid1.image.oc1..." --display-
name="myInstance" \
--shape="VM.Standard2.1" --subnet="ocid1.subnet.oc1..."
```

Terminating a Cloud Instance

To terminate an instance in your compartment on Oracle Cloud Infrastructure:

```
VBoxManage cloud --provider="OCI" --profile="vbox-oci" instance terminate \
--id="ocid1.instance.oc1..."
```

For more details about the available commands for cloud operations, see VBoxManage cloud.

Preferences

The Preferences window offers a selection of settings, which apply to all virtual machines of the current user.

To display the Preferences window, do either of the following:

- Select **File**, **Preferences**.
- Click **Preferences** on the Welcome screen in VirtualBox Manager.

The following settings are available:

- **General.** Enables you to specify the default folder or directory for VM files, and the VRDP Authentication Library.
- **Input.** Enables you to specify keyboard shortcuts, such as the **Host key**. This is the key that toggles whether the cursor is in the focus of the VM or the Host OS windows, see Capturing and Releasing Keyboard and Mouse. The Host key is also used to trigger certain VM actions, see Typing Special Characters.
- **Update.** Enables you to specify various settings for Automatic Updates.
- **Language.** Enables you to specify the language used for menus, labels, and text in VirtualBox Manager.
- **Display.** Enables you to specify the screen resolution, and its width and height. A default scale factor can be specified for all guest screens.
- **Proxy.** Enables you to configure an HTTP Proxy Server.
- **Interface.** Enables you to select a color theme for the VirtualBox Manager user interface.

> **Note:**
>
> This setting is only available on Windows host platforms.

Alternative Front-Ends

As briefly mentioned in Features Overview, Oracle VM VirtualBox has a very flexible internal design that enables you to use multiple interfaces to control the same virtual machines. For example, you can start a virtual machine with the VirtualBox Manager window and then stop it from the command line. With Oracle VM VirtualBox's support for the Remote Desktop Protocol (RDP), you can even run virtual machines remotely on a headless server and have all the graphical output redirected over the network.

The following front-ends are shipped in the standard Oracle VM VirtualBox package:

- **VirtualBox.** This is the VirtualBox Manager, a graphical user interface that uses the Qt toolkit. This interface is described throughout this manual. While this is the simplest and easiest front-end to use, some of the more advanced Oracle VM VirtualBox features are not included.
- **VBoxManage.** A command-line interface for automated and detailed control of every aspect of Oracle VM VirtualBox. See VBoxManage.
- **VBoxHeadless.** A front-end that produces no visible output on the host at all, but can act as a RDP server if the VirtualBox Remote Desktop Extension (VRDE) is installed and enabled for the VM. As opposed to the other graphical interfaces, the headless front-end requires no graphics support. This is useful, for example, if you want to host your virtual machines on a headless Linux server that has no X Window system installed. See VBoxHeadless, the Remote Desktop Server.

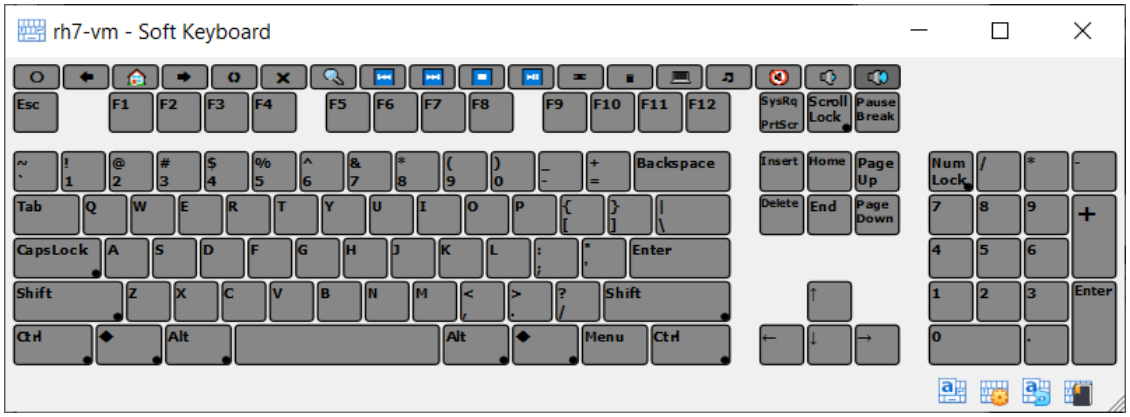
If the above front-ends still do not satisfy your particular needs, it is possible to create yet another front-end to the complex virtualization engine that is the core of Oracle VM VirtualBox, as the Oracle VM VirtualBox core neatly exposes all of its features in a clean API. See Oracle VM VirtualBox Programming Interfaces.

Soft Keyboard

Oracle VM VirtualBox provides a *soft keyboard* that enables you to input keyboard characters on the guest. A soft keyboard is an on-screen keyboard that can be used as an alternative to a physical keyboard. See Using the Soft Keyboard for details of how to use the soft keyboard.

> **Caution:**
>
> For best results, ensure that the keyboard layout configured on the guest OS matches the keyboard layout used by the soft keyboard. Oracle VM VirtualBox does not do this automatically.

Figure 1-28 Soft Keyboard in a Guest Virtual Machine



The soft keyboard can be used in the following scenarios:

- When the physical keyboard on the host is not the same as the keyboard layout configured on the guest. For example, if the guest is configured to use an international keyboard, but the host keyboard is US English.
- To send special key combinations to the guest. Note that some common key combinations are also available in the **Input**, **Keyboard** menu of the guest VM window. See Typing Special Characters.
- For guests in kiosk mode, where a physical keyboard is not present.
- When using nested virtualization, the soft keyboard provides a method of sending key presses to a guest.

By default, the soft keyboard includes some common international keyboard layouts. You can copy and modify these to meet your own requirements. See Creating a Custom Keyboard Layout.

Using the Soft Keyboard

1. Display the soft keyboard.

   In the guest VM window, select **Input**, **Keyboard**, **Soft Keyboard**.

2. Select the required keyboard layout.

   The name of the current keyboard layout is displayed in the toolbar of the soft keyboard window. This is the previous keyboard layout that was used.

   Click the **Layout List** icon in the toolbar of the soft keyboard window. The **Layout List** window is displayed.

   Select the required keyboard layout from the entries in the **Layout List** window.

   The keyboard display graphic is updated to show the available input keys.

3. Use the soft keyboard to enter keyboard characters on the guest.

   - Modifier keys such as Shift, Ctrl, and Alt are available on the soft keyboard. Click once to select the modifier key, click twice to lock the modifier key.

     The **Reset the Keyboard and Release All Keys** icon can be used to release all pressed modifier keys, both on the host and the guest.

- To change the look of the soft keyboard, click the **Settings** icon in the toolbar. You can change colors used in the keyboard graphic, and can hide or show sections of the keyboard, such as the NumPad or multimedia keys.

Creating a Custom Keyboard Layout

You can use one of the supplied default keyboard layouts as the starting point to create a custom keyboard layout.

> **Note:**
>
> To permananently save a custom keyboard layout, you must save it to a file. Otherwise, any changes you make are discarded when you close down the **Soft Keyboard** window.
>
> Custom keyboard layouts that you save are stored as an XML file on the host, in the `keyboardLayouts` folder in the global configuration data directory. For example, in `$HOME/.config/VirtualBox/keyboardLayouts` on a Linux host.

1. Display the **Layout List**.

   Click the **Layout List** icon in the toolbar of the soft keyboard window.
2. Make a copy of an existing keyboard layout.

   Highlight the required layout and click the **Copy the Selected Layout** icon.

   A new layout entry with a name suffix of `-Copy` is created.
3. Edit the new keyboard layout.

   Highlight the new layout in the **Layout List** and click the **Edit the Selected Layout** icon.

   Enter a new name for the layout.

   Edit keys in the new layout. Click on the key that you want to edit and enter new key captions in the **Captions** fields.

   The keyboard graphic is updated with the new captions.
4. (Optional) Save the layout to a file. This means that your custom keyboard layout will be available for future use.

   Highlight the new layout in the **Layout List** and click the **Save the Selected Layout into File** icon.

   Any custom layouts that you create can later be removed from the Layout List, by highlighting and clicking the **Delete the Selected Layout** icon.

Monitoring of Virtual Machines

VirtualBox Manager includes the following tools for viewing runtime information and changing the configuration of virtual machines.

- **VM Activity Overview.** Displays an overview of performance metrics for all running VMs.

  See VM Activity Overview.
- **Session Information Dialog.** Displays configuration and runtime information for the selected guest system.

See Session Information Dialog

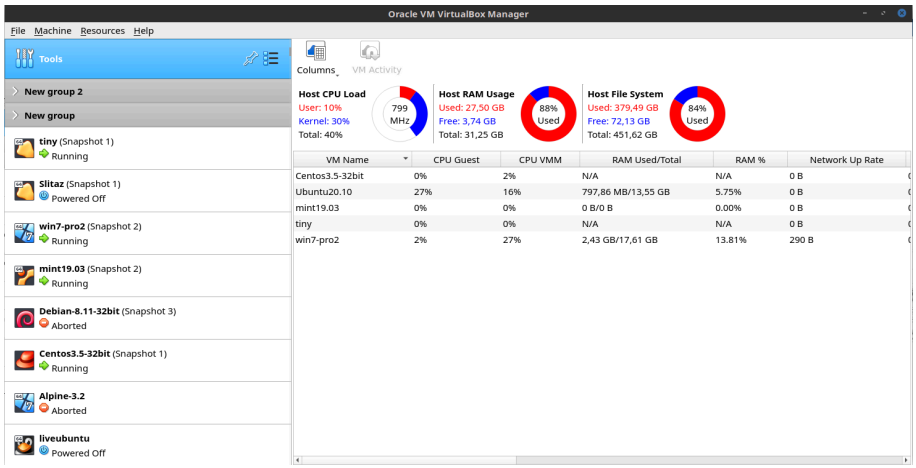
VM Activity Overview

The VM Activity Overview tool displays several performance metrics for all running virtual machines and for the host system. This provides an overview of system resources used by individual virtual machines and the host system.

To display the VM Activity Overview tool, do the following:

Go to the global **Tools** menu and click **Activities**. The **VM Activity Overview** window is shown.

Figure 1-29 VM Activity Overview Tool



To show metrics for *all* virtual machines, including those that are not running, right-click on the list of virtual machines and select **List All Virtual Machines**.

To configure the set of metrics to be shown, click **Columns** in the toolbar. You can then sort the list of virtual machines by a particular metric.

To see more performance information for a virtual machine, select the VM name and click **VM Activity** in the toolbar. The **VM Activity** tab of the **Session Information** dialog is shown, see Session Information Dialog.

Session Information Dialog

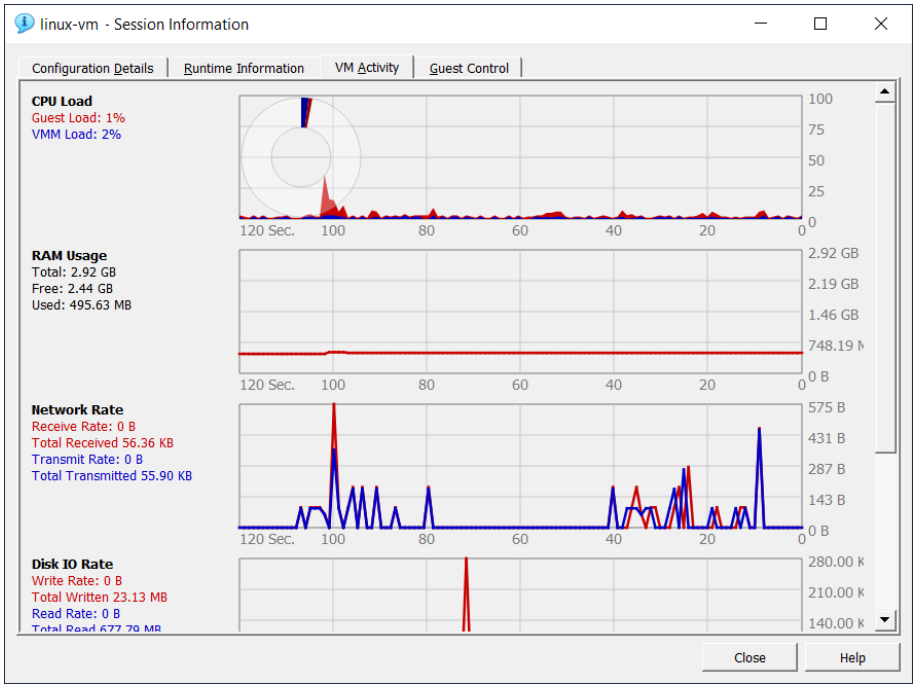
The Session Information dialog includes multiple tabs which show important configuration and runtime information for the guest system. The tabs of the dialog are as follows:

- **Configuration Details.** Displays the system configuration of the virtual machine in a tabular format. The displayed information includes details such as storage configuration and audio settings.
- **Runtime Information.** Displays runtime information for the guest session in a tabular format similar to the Configuration Details tab.
- **VM Activity.** Includes several time series charts which monitor guest resource usage including CPU, RAM, Disk I/O, and Network. Note that the RAM chart requires the Guest Additions to be running on the guest system. The VM Activity tab can also be accessed directly from the VM Activity Overview tool. See VM Activity Overview.

- **Guest Control**. Details of processes used by the Guest Control File Manager. See Guest Control File Manager.

To display the Session Information dialog, select **Machine**, **Session Information** in the guest VM.

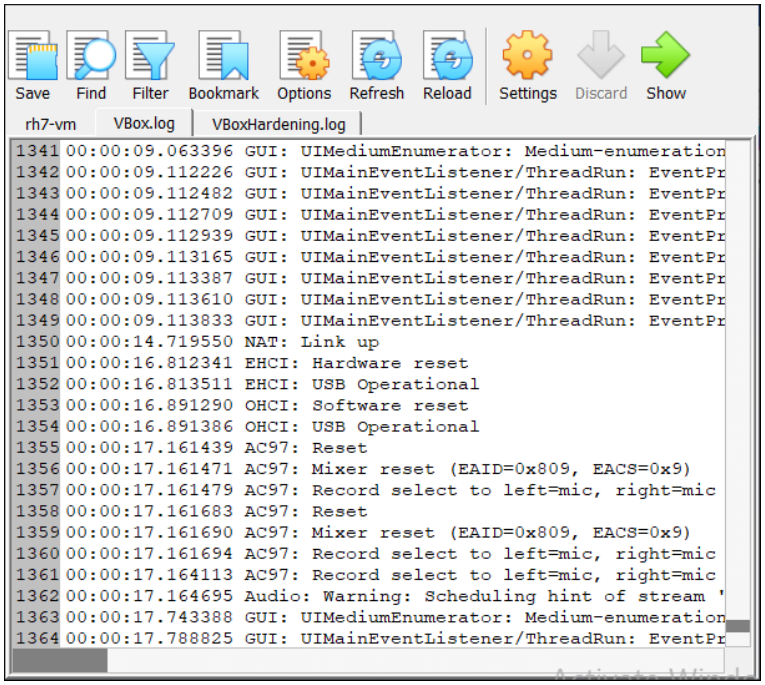
Figure 1-30 Session Information Dialog, Showing VM Activity Tab



The Log Viewer

Every time you start up a VM, Oracle VM VirtualBox creates a log file that records system configuration and events. The **Log Viewer** is a VirtualBox Manager tool that enables you to view and analyze system logs.

Figure 1-31 Log Viewer Tool, Showing System Events



To display the Log Viewer, do either of the following:

- Click the VM name in the machine list and select **Logs** from the machine tools menu.
- In the guest VM, select **Machine**, **Show Log**.

Log messages for the VM are displayed in tabs in the Log Viewer window. See Collecting Debugging Information for details of the various log files generated by Oracle VM VirtualBox.

If you select multiple VMs in the machine list, logs are listed for each VM.

The toolbar of the Log Viewer includes the following options:

- **Save:** Exports the contents of the selected log file to a text file. Specify the destination filename and location in the displayed dialog.
- **Find:** Searches for a text string in the log file.
- **Filter:** Uses filter terms to display specific types of log messages. Common log message terms used by Oracle VM VirtualBox, such as Audio and NAT, are included by default. Select one or more terms from the drop-down list. To add your own filter term, enter the text string in the text box field.
- **Bookmark:** Saves the location of a log message, enabling you to find it quickly. To create a bookmark, either click on the line number, or select some text and then click **Bookmark**.
- **Options:** Configures the text display used in the log message window.
- **Refresh:** Refreshes the log file you are currently viewing. Only log messages in the current tab are updated.
- **Reload:** Refreshes all log files. Log messages in every tab are updated.
- **Settings:** Displays the **Settings** window for the VM, enabling you to make configuration changes.
- **Discard:** For a running VM, discards the saved state for the VM and closes it down.

- **Show/Start:** For a running VM, **Show** displays the VM window. For a stopped VM, **Start** displays options for powering up the VM.

2 Installation Details

As installation of Oracle VM VirtualBox varies depending on your host operating system, the following sections provide installation instructions for Windows, macOS, Linux, and Oracle Solaris.

Installing on Windows Hosts

Prerequisites

For the various versions of Windows that are supported as host operating systems, please refer to Supported Host Operating Systems.

In addition, Windows Installer must be present on your system. This should be the case for all supported Windows platforms.

Windows Installation Directory Security Requirements

The installation directory on Windows hosts must meet certain security requirements to be accepted by the Windows installer.

This also applies for upgrades of Oracle VM VirtualBox.

For example, when installing Oracle VM VirtualBox into a custom location at `X:\Data\MyPrograms\Oracle VM VirtualBox`, all parent directories of this path (namely `X:\Data and X:\Data\MyPrograms`) must meet the following Discretionary Access Control List (DACL).

```
Users              S-1-5-32-545:(OI)(CI)(RX)
Users              S-1-5-32-545:(DE,WD,AD,WEA,WA)
Authenticated Users S-1-5-11:(OI)(CI)(RX)
Authenticated Users S-1-5-11:(DE,WD,AD,WEA,WA)
```

Directory inheritance must also be disabled for all parent directories.

You can use the `icacls` Windows command line tool to modify a directory to meet the security requirements. For example:

```
icacls <Directory> /reset /t /c
icacls <Directory> /inheritance:d /t /c
icacls <Directory> /grant *S-1-5-32-545:(OI)(CI)(RX)
icacls <Directory> /deny  *S-1-5-32-545:(DE,WD,AD,WEA,WA)
icacls <Directory> /grant *S-1-5-11:(OI)(CI)(RX)
icacls <Directory> /deny  *S-1-5-11:(DE,WD,AD,WEA,WA)
```

Note that these commands must be repeated for all parent directories (`X:\Data and X:\Data\MyPrograms` in this example).

Performing the Installation

The Oracle VM VirtualBox installation can be started in either of the following ways:

- By double-clicking on the executable file.
- By entering the following command:

  ```
  VirtualBox-<version>-<revision>-Win.exe -extract
  ```

  This will extract the installer into a temporary directory, along with the .MSI file. Run the following command to perform the installation:

  ```
  msiexec /i VirtualBox-<version>-<revision>-Win.msi
  ```

Using either way displays the installation **Welcome** dialog and enables you to choose where to install Oracle VM VirtualBox, and which components to install. In addition to the Oracle VM VirtualBox application, the following components are available:

- **USB support.** This package contains special drivers for your Windows host that Oracle VM VirtualBox requires to fully support USB devices inside your virtual machines.
- **Networking.** This package contains extra networking drivers for your Windows host that Oracle VM VirtualBox needs to support Bridged Networking. This enables your VM's virtual network cards to be accessed from other machines on your physical network.
- **Python support.** This package contains Python scripting support for the Oracle VM VirtualBox API, see Oracle VM VirtualBox Programming Interfaces. For this to work, an already working Windows Python installation on the system is required.

  See, for example: http://www.python.org/download/windows/.

> **Note:**
>
> Python version at least 2.6 is required. Python 3 is also supported.

Depending on your Windows configuration, you may see warnings about unsigned drivers, or similar. Click **Continue** for these warnings, as otherwise Oracle VM VirtualBox might not function correctly after installation.

The installer will create an Oracle VM VirtualBox group in the Windows **Start** menu, which enables you to launch the application and access its documentation.

With standard settings, Oracle VM VirtualBox will be installed for all users on the local system. If this is not wanted, you must invoke the installer by first extracting as follows:

```
VirtualBox.exe -extract
```

Then, run either of the following commands on the extracted .MSI file. This will install Oracle VM VirtualBox only for the current user.

```
VirtualBox.exe -msiparams ALLUSERS=2

msiexec /i VirtualBox-<version>-Win.msi ALLUSERS=2
```

If you do not want to install all features of Oracle VM VirtualBox, you can set the optional `ADDLOCAL` parameter to explicitly name the features to be installed. The following features are available:

VBoxApplication
Main binaries of Oracle VM VirtualBox.

> **Note:**
>
> This feature must not be absent, since it contains the minimum set of files to have working Oracle VM VirtualBox installation.

VBoxUSB
USB support.

VBoxNetwork
All networking support. This includes the VBoxNetworkFlt and VBoxNetworkAdp features.

VBoxNetworkFlt
Bridged networking support.

VBoxNetworkAdp
Host-only networking support

VBoxPython
Python support

For example, to only install USB support along with the main binaries, run either of the following commands:

```
VirtualBox.exe -msiparams ADDLOCAL=VBoxApplication,VBoxUSB

msiexec /i VirtualBox-<version>-Win.msi ADDLOCAL=VBoxApplication,VBoxUSB
```

The user is able to choose between NDIS5 and NDIS6 host network filter drivers during the installation. This is done using a command line parameter, `NETWORKTYPE`. The NDIS6 driver is the default for most supported Windows hosts. For some legacy Windows versions, the installer will automatically select the NDIS5 driver and this cannot be changed.

You can force an install of the legacy NDIS5 host network filter driver by specifying `NETWORKTYPE=NDIS5`. For example, to install the NDIS5 driver on Windows 7 use either of the following commands:

```
VirtualBox.exe -msiparams NETWORKTYPE=NDIS5

msiexec /i VirtualBox-<version>-Win;.msi NETWORKTYPE=NDIS5
```

Uninstallation

As Oracle VM VirtualBox uses the standard Microsoft Windows installer, Oracle VM VirtualBox can be safely uninstalled at any time. Click the program entry in the **Add/Remove Programs** list in the Windows Control Panel.

Unattended Installation

Unattended installations can be performed using the standard MSI support.

Public Properties

Public properties can be specified with the MSI API, to control additional behavior and features of the Windows host installer. Use either of the following commands:

```
VirtualBox.exe -msiparams NAME=VALUE [...]

msiexec /i VirtualBox-<version>-Win.msi NAME=VALUE [...]
```

The following public properties are available.

- VBOX_INSTALLDESKTOPSHORTCUT

  Specifies whether or not an Oracle VM VirtualBox icon on the desktop should be created.

  Set to `1` to enable, `0` to disable. Default is 1.

- VBOX_INSTALLQUICKLAUNCHSHORTCUT

  Specifies whether or not an Oracle VM VirtualBox icon in the Quick Launch Bar should be created.

  Set to `1` to enable, `0` to disable. Default is 1.

- VBOX_REGISTERFILEEXTENSIONS

  Specifies whether or not the file extensions .vbox, .vbox-extpack, .ovf, .ova, .vdi, .vmdk, .vhd and .vdd should be associated with Oracle VM VirtualBox. Files of these types then will be opened with Oracle VM VirtualBox.

  Set to `1` to enable, `0` to disable. Default is 1.

- VBOX_START

  Specifies whether to start Oracle VM VirtualBox right after successful installation.

  Set to `1` to enable, `0` to disable. Default is 1.

Installing on macOS Hosts

Performing the Installation

For macOS hosts, Oracle VM VirtualBox ships in a `dmg` disk image file. Perform the following steps to install on a macOS host:

1. Double-click on the `dmg` file, to mount the contents.
2. A window opens, prompting you to double-click on the `VirtualBox.pkg` installer file displayed in that window.
3. This starts the installer, which enables you to select where to install Oracle VM VirtualBox.
4. An Oracle VM VirtualBox icon is added to the `Applications` folder in the Finder.

Uninstallation

To uninstall Oracle VM VirtualBox, open the disk image `dmg` file and double-click on the uninstall icon shown.

Unattended Installation

To perform a non-interactive installation of Oracle VM VirtualBox you can use the command line version of the installer application.

Mount the `dmg` disk image file, as described in the installation procedure, or use the following command line:

```
hdiutil attach /path/to/VirtualBox-xyz.dmg
```

Open a terminal session and run the following command:

```
sudo installer -pkg /Volumes/VirtualBox/VirtualBox.pkg -target /Volumes/Macintosh\ HD
```

Installing on Linux Hosts

Prerequisites

For the various versions of Linux that are supported as host operating systems, see Supported Host Operating Systems.

You may need to install the following packages on your Linux system before starting the installation. Some systems will do this for you automatically when you install Oracle VM VirtualBox.

- Qt 5.3.2 or later. Qt 5.6.2 or later is recommended.
- SDL 1.2.7 or later. This graphics library is typically called `libsdl` or similar.

> **Note:**
>
> These packages are only required if you want to run the Oracle VM VirtualBox graphical user interfaces. In particular, `VirtualBox`, the graphical VirtualBox Manager, requires both Qt and SDL. If you only want to run `VBoxHeadless`, neither Qt nor SDL are required.

The Oracle VM VirtualBox Kernel Modules

In order to run other operating systems in virtual machines alongside your main operating system, Oracle VM VirtualBox needs to integrate very tightly with your system. To do this it installs a driver module called `vboxdrv` into the system kernel. The kernel is the part of the operating system which controls your processor and physical hardware. Without this kernel module, you can still use VirtualBox Manager to configure virtual machines, but they will not start.

Network drivers called `vboxnetflt` and `vboxnetadp` are also installed. They enable virtual machines to make more use of your computer's network capabilities and are needed for any virtual machine networking beyond the basic NAT mode.

Since distributing driver modules separately from the kernel is not something which Linux supports well, the Oracle VM VirtualBox install process creates the modules on the system where they will be used. This means that you may need to install some software packages

from the distribution which are needed for the build process. Required packages may include the following:

- GNU compiler (GCC)
- GNU Make (make)
- Kernel header files

Also ensure that all system updates have been installed and that your system is running the most up-to-date kernel for the distribution.

> **Note:**
>
> The running kernel and the kernel header files must be updated to matching versions.

The following list includes some details of the required files for some common distributions. Start by finding the version name of your kernel, using the command `uname -r` in a terminal. The list assumes that you have not changed too much from the original installation, in particular that you have not installed a different kernel type.

- With Debian and Ubuntu-based distributions, you must install the correct version of the `linux-headers`, usually whichever of `linux-headers-generic`, `linux-headers-amd64`, `linux-headers-i686` or `linux-headers-i686-pae` best matches the kernel version name. Also, the `linux-kbuild` package if it exists. Basic Ubuntu releases should have the correct packages installed by default.
- On Fedora, Red Hat, Oracle Linux and many other RPM-based systems, the kernel version sometimes has a code of letters or a word close to the end of the version name. For example "uek" for the Oracle Unbreakable Enterprise Kernel or "default" or "desktop" for the standard kernels. In this case, the package name is `kernel-uek-devel` or equivalent. If there is no such code, it is usually `kernel-devel`.
- On some SUSE and openSUSE Linux versions, you may need to install the `kernel-source` and `kernel-syms` packages.

If you suspect that something has gone wrong with module installation, check that your system is set up as described above and try running the following command, as root:

```
rcvboxdrv setup
```

Kernel Modules and UEFI Secure Boot

If you are running on a system using UEFI (Unified Extensible Firmware Interface) Secure Boot, you may need to sign the following kernel modules before you can load them:

- `vboxdrv`
- `vboxnetadp`
- `vboxnetflt`
- `vboxpci`

See your system documentation for details of the kernel module signing process.

Performing the Installation

Oracle VM VirtualBox is available in a number of package formats native to various common Linux distributions. See Supported Host Operating Systems. In addition, there is an alternative generic installer (.run) which you can use on supported Linux distributions.

Installing Oracle VM VirtualBox from a Debian or Ubuntu Package

Download the appropriate package for your distribution. The following example assumes that you are installing to a 64-bit Ubuntu Xenial system. Use `dpkg` to install the Debian package,as follows:

```
sudo dpkg -i virtualbox-version-number_Ubuntu_xenial_amd64.deb
```

The installer will also try to build kernel modules suitable for the current running kernel. If the build process is not successful you will be shown a warning and the package will be left unconfigured. Look at `/var/log/vbox-install.log` to find out why the compilation failed. You may have to install the appropriate Linux kernel headers, see The Oracle VM VirtualBox Kernel Modules. After correcting any problems, run the following command:

```
sudo rcvboxdrv setup
```

This will start a second attempt to build the module.

If a suitable kernel module was found in the package or the module was successfully built, the installation script will attempt to load that module. If this fails, please see Linux Kernel Module Refuses to Load for further information.

Once Oracle VM VirtualBox has been successfully installed and configured, you can start it by clicking **VirtualBox** in your **Start** menu or from the command line. See Starting Oracle VM VirtualBox on Linux.

Using the Alternative Generic Installer (VirtualBox.run)

The alternative generic installer performs the following steps:

- Unpacks the application files to the target directory `/opt/VirtualBox/`, which cannot be changed.
- Builds and installs the Oracle VM VirtualBox kernel modules: `vboxdrv`, `vboxnetflt`, and `vboxnetadp`.
- Creates `/sbin/rcvboxdrv`, an init script to start the Oracle VM VirtualBox kernel module.
- Creates a new system group called `vboxusers`.
- Creates symbolic links in `/usr/bin` to a shell script `/opt/VirtualBox/VBox` which does some sanity checks and dispatches to the actual executables: `VirtualBox`, `VBoxVRDP`, `VBoxHeadless` and `VBoxManage`.
- Creates `/etc/udev/rules.d/60-vboxdrv.rules`, a description file for udev, if that is present, which makes the USB devices accessible to all users in the `vboxusers` group.
- Writes the installation directory to `/etc/vbox/vbox.cfg`.

The installer must be executed as root with either `install` or `uninstall` as the first parameter. For example:

```
sudo ./VirtualBox.run install
```

Or if you do not have the `sudo` command available, run the following as root instead:

```
./VirtualBox.run install
```

Add every user who needs to access USB devices from a VirtualBox guests to the group `vboxusers`. Either use the OS user management tools or run the following command as root:

```
sudo usermod -a -G vboxusers username
```

> **Note:**
>
> The `usermod` command of some older Linux distributions does not support the `-a` option, which adds the user to the given group without affecting membership of other groups. In this case, find out the current group memberships with the `groups` command and add all these groups in a comma-separated list to the command line after the `-G` option. For example: `usermod -G group1,group2,vboxusers username`.

Performing a Manual Installation

If you cannot use the shell script installer described in Using the Alternative Generic Installer (VirtualBox.run), you can perform a manual installation. Run the installer as follows:

```
./VirtualBox.run --keep --noexec
```

This will unpack all the files needed for installation in the directory `install` under the current directory. The Oracle VM VirtualBox application files are contained in `VirtualBox.tar.bz2` which you can unpack to any directory on your system. For example:

```
sudo mkdir /opt/VirtualBox
sudo tar jxf ./install/VirtualBox.tar.bz2 -C /opt/VirtualBox
```

To run the same example as root, use the following commands:

```
mkdir /opt/VirtualBox
tar jxf ./install/VirtualBox.tar.bz2 -C /opt/VirtualBox
```

The sources for Oracle VM VirtualBox's kernel module are provided in the `src` directory. To build the module, change to the directory and use the following command:

```
make
```

If everything builds correctly, run the following command to install the module to the appropriate module directory:

```
sudo make install
```

In case you do not have sudo, switch the user account to root and run the following command:

```
make install
```

The Oracle VM VirtualBox kernel module needs a device node to operate. The above `make` command will tell you how to create the device node, depending on your Linux system. The procedure is slightly different for a classical Linux setup with a `/dev` directory, a system with the now deprecated `devfs` and a modern Linux system with `udev`.

On certain Linux distributions, you might experience difficulties building the module. You will have to analyze the error messages from the build system to diagnose the cause of the problems. In general, make sure that the correct Linux kernel sources are used for the build process.

Note that the `/dev/vboxdrv` kernel module device node must be owned by root:root and must be read/writable only for the user.

Next, you install the system initialization script for the kernel module and activate the initialization script using the right method for your distribution, as follows:

```
cp /opt/VirtualBox/vboxdrv.sh /sbin/rcvboxdrv
```

This example assumes you installed Oracle VM VirtualBox to the `/opt/VirtualBox` directory.

Create a configuration file for Oracle VM VirtualBox, as follows:

```
mkdir /etc/vbox
echo INSTALL_DIR=/opt/VirtualBox > /etc/vbox/vbox.cfg
```

Create the following symbolic links:

```
ln -sf /opt/VirtualBox/VBox.sh /usr/bin/VirtualBox
ln -sf /opt/VirtualBox/VBox.sh /usr/bin/VBoxManage
ln -sf /opt/VirtualBox/VBox.sh /usr/bin/VBoxHeadless
```

Updating and Uninstalling Oracle VM VirtualBox

Before updating or uninstalling Oracle VM VirtualBox, you must terminate any virtual machines which are currently running and exit the Oracle VM VirtualBox or VBoxSVC applications. To update Oracle VM VirtualBox, simply run the installer of the updated version. To uninstall Oracle VM VirtualBox, run the installer as follows:

```
sudo ./VirtualBox.run uninstall
```

As root, you can use the following command:

```
./VirtualBox.run uninstall
```

You can uninstall the .run package as follows:

```
/opt/VirtualBox/uninstall.sh
```

To manually uninstall Oracle VM VirtualBox, perform the manual installation steps in reverse order.

Automatic Installation of Debian Packages

The Debian packages will request some user feedback when installed for the first time. The debconf system is used to perform this task. To prevent any user interaction during installation, default values can be defined. A file `vboxconf` can contain the following debconf settings:

```
virtualbox virtualbox/module-compilation-allowed boolean true
virtualbox virtualbox/delete-old-modules boolean true
```

The first line enables compilation of the vboxdrv kernel module if no module was found for the current kernel. The second line enables the package to delete any old vboxdrv kernel modules compiled by previous installations.

These default settings can be applied prior to the installation of the Oracle VM VirtualBox Debian package, as follows:

```
debconf-set-selections vboxconf
```

In addition there are some common configuration options that can be set prior to the installation. See Automatic Installation Options.

Automatic Installation of RPM Packages

The RPM format does not provide a configuration system comparable to the debconf system. See Automatic Installation Options for how to set some common installation options provided by Oracle VM VirtualBox.

Automatic Installation Options

To configure the installation process for .deb and .rpm packages, you can create a response file named `/etc/default/virtualbox`. The automatic generation of the udev rule can be prevented with the following setting:

```
INSTALL_NO_UDEV=1
```

The creation of the group vboxusers can be prevented as follows:

```
INSTALL_NO_GROUP=1
```

If the following line is specified, the package installer will not try to build the `vboxdrv` kernel module if no module fitting the current kernel was found.

```
INSTALL_NO_VBOXDRV=1
```

The vboxusers Group

The Linux installers create the system user group `vboxusers` during installation. Any system user who is going to use USB devices from Oracle VM VirtualBox guests must be a member of that group. A user can be made a member of the group `vboxusers` either by using the desktop user and group tools, or with the following command:

```
sudo usermod -a -G vboxusers username
```

Starting Oracle VM VirtualBox on Linux

The easiest way to start an Oracle VM VirtualBox program is by running the program of your choice (`VirtualBox`, `VBoxManage`, or `VBoxHeadless`) from a terminal. These are symbolic links to `VBox.sh` that start the required program for you.

The following detailed instructions should only be of interest if you wish to execute Oracle VM VirtualBox without installing it first. You should start by compiling the `vboxdrv` kernel module and inserting it into the Linux kernel. Oracle VM VirtualBox consists of a service daemon, `VBoxSVC`, and several application programs. The daemon is automatically started if necessary. All Oracle VM VirtualBox applications will communicate with the daemon through UNIX local domain sockets. There can be multiple daemon instances under different user accounts and applications can only communicate with the daemon running under the user account as the application. The local domain socket resides in a subdirectory of your system's directory for temporary files called `.vbox-<username>-ipc`. In case of communication problems or server startup problems, you may try to remove this directory.

All Oracle VM VirtualBox applications (`VirtualBox`, `VBoxManage`, and `VBoxHeadless`) require the Oracle VM VirtualBox directory to be in the library path, as follows:

```
LD_LIBRARY_PATH=. ./VBoxManage showvminfo "Windows XP"
```

Installing on Oracle Solaris Hosts

For the specific versions of Oracle Solaris that are supported as host operating systems, see Supported Host Operating Systems.

If you have a previously installed instance of Oracle VM VirtualBox on your Oracle Solaris host, please uninstall it first before installing a new instance. See Uninstallation for uninstall instructions.

Performing the Installation

Oracle VM VirtualBox is available as a standard Oracle Solaris package. Download the Oracle VM VirtualBox SunOS package, which includes the 64-bit version of Oracle VM VirtualBox. *The installation must be performed as root and from the global zone*. This is because the Oracle VM VirtualBox installer loads kernel drivers, which cannot be done from non-global zones. To verify which zone you are currently in, execute the `zonename` command.

To start installation, run the following commands:

```
gunzip -cd VirtualBox-version-number-SunOS.tar.gz | tar xvf -
```

The Oracle VM VirtualBox kernel package is integrated into the main package. Install the Oracle VM VirtualBox package as follows:

```
pkgadd -d VirtualBox-version-number-SunOS.pkg
```

The installer will then prompt you to enter the package you wish to install. Choose **1** or **all** and proceed. Next the installer will ask you if you want to allow the postinstall script to be executed. Choose **y** and proceed, as it is essential to execute this script which installs the Oracle VM VirtualBox kernel module. Following this confirmation the installer will install Oracle VM VirtualBox and execute the postinstall setup script.

Once the postinstall script has been executed your installation is now complete. You may now safely delete the uncompressed package and `autoresponse` files from your system. Oracle VM VirtualBox is installed in `/opt/VirtualBox`.

> **Note:**
>
> If you need to use Oracle VM VirtualBox from non-global zones, see Configuring a Non-Global Zone for Running Oracle VM VirtualBox.

The vboxuser Group

The installer creates the system user group `vboxuser` during installation for Oracle Solaris hosts that support the USB features required by Oracle VM VirtualBox. Any system user who is going to use USB devices from Oracle VM VirtualBox guests must be a member of this group. A user can be made a member of this group either by using the desktop user and group tools or by running the following command as root:

```
usermod -G vboxuser username
```

Note that adding an active user to the `vboxuser` group will require the user to log out and then log in again. This should be done manually after successful installation of the package.

Starting Oracle VM VirtualBox on Oracle Solaris

The easiest way to start an Oracle VM VirtualBox program is by running the program of your choice (`VirtualBox`, `VBoxManage`, or `VBoxHeadless`) from a terminal. These are symbolic links to `VBox.sh` that start the required program for you.

Alternatively, you can directly invoke the required programs from `/opt/VirtualBox`. Using the links provided is easier as you do not have to enter the full path.

You can configure some elements of the `VirtualBox` Qt GUI, such as fonts and colours, by running `VBoxQtconfig` from the terminal.

Uninstallation

Uninstallation of Oracle VM VirtualBox on Oracle Solaris requires root permissions. To perform the uninstallation, start a root terminal session and run the following command:

```
pkgrm SUNWvbox
```

After confirmation, this will remove Oracle VM VirtualBox from your system.

Unattended Installation

To perform a non-interactive installation of Oracle VM VirtualBox there is a response file named `autoresponse`. The installer uses this for responses to inputs, rather than prompting the user.

Extract the tar.gz package as described in Performing the Installation. Then open a root terminal session and run the following command:

```
pkgadd -d VirtualBox-version-number-SunOS-x86 -n -a autoresponse SUNWvbox
```

To perform a non-interactive uninstallation, open a root terminal session and run the following command:

```
pkgrm -n -a /opt/VirtualBox/autoresponse SUNWvbox
```

Configuring a Non-Global Zone for Running Oracle VM VirtualBox

After installing Oracle VM VirtualBox in the global zone (see Installing on Oracle Solaris Hosts for the installation instructions) the first step required to run Oracle VM VirtualBox in a non-global zone is to modify the zone's configuration to be able to access the Oracle VM VirtualBox device nodes located in the global zone. This is done by performing the following steps as a zone administrator in the global zone.

```
global$ zonecfg -z vboxzone
```

Replace *vboxzone* with the name of the non-gloabl zone where you plan to run Oracle VM VirtualBox.

Use `zonecfg(8)` to add the `device` resource and the `match` property for each Oracle VM VirtualBox device node in the global zone to the non-global zone as follows:

```
zonecfg:vboxzone> add device
zonecfg:vboxzone:device> set match=/dev/vboxdrv
zonecfg:vboxzone:device> end
zonecfg:vboxzone> add device
zonecfg:vboxzone:device> set match=/dev/vboxdrvu
zonecfg:vboxzone:device> end
zonecfg:vboxzone> exit
```

On Oracle Solaris 11 if you plan to use VMs configured to use a USB device, e.g. a USB pointing device or a USB pass-through device, you should also pass through the `/dev/vboxusbmon` device using the steps above.

Oracle Solaris 11 does not support sparse root zones so you will need to loopback mount `/opt/VirtualBox` from the global zone into the non-global zone at the same path. This is done using `zonecfg(8)` to set the `dir` attribute and the `special` attribute for this directory. For example:

```
zonecfg:vboxzone> add fs
zonecfg:vboxzone:fs> set dir=/opt/VirtualBox
zonecfg:vboxzone:fs> set special=/opt/VirtualBox
zonecfg:vboxzone:fs> set type=lofs
zonecfg:vboxzone:fs> add options [readonly]
zonecfg:vboxzone:fs> end
zonecfg:vboxzone> exit
```

After making the above changes using `zonecfg(8)`, reboot the zone using `zoneadm(8)` as follows:

```
global$ zoneadm -z vboxzone reboot
```

for the changes to take effect. You will then be able to run Oracle VM VirtualBox from /opt/VirtualBox within the configured non-global zone.

Installing an Extension Pack

Extension packs provide extra functionality to the Oracle VM VirtualBox base package, such as extended USB device support and cloud integration features. See Installing Oracle VM VirtualBox and Extension Packs.

To install an Oracle VM VirtualBox Extension Pack, do the following:

1. Double-click on the extension package file name.

   Oracle VM VirtualBox extension packs have a `.vbox-extpack` file name extension.

2. Follow the on-screen instructions to install the extension pack.

You can also use the Extension Pack Manager tool to install an extension pack. See The Extension Pack Manager.

The Extension Pack Manager

Extension packs can be installed and managed using the **Extension Pack Manager** tool in VirtualBox Manager.

The Extension Pack Manager lists the extension packs that are currently installed on the host, and enables you to install and uninstall extension packs.

To display the Extension Pack Manager, go to the global **Tools** menu and click **Extensions**. The Extension Pack Manager is shown.

To install an extension pack using the Extension Pack Manager, click **Install** and select an extension package file. The extension pack is installed on the host and listed in Extension Pack Manager.

To uninstall an extension pack with the Extension Pack Manager, do the following:

1. Select the extension pack in the Extension Pack Manager window and click **Uninstall**.
2. Click **Remove** in the prompt dialog.

   The extension pack is uninstalled from the host and removed from the Extension Pack Manager.

Alternatively, you can use the `VBoxManage` command line to install and manage an Oracle VM VirtualBox Extension Pack. See VBoxManage extpack.

3
Configuring Virtual Machines

This chapter provides detailed steps for configuring an Oracle VM VirtualBox virtual machine (VM). For an introduction to Oracle VM VirtualBox and steps to get your first virtual machine running, see First Steps.

You have considerable latitude when deciding what virtual hardware to provide to the guest. Use virtual hardware to communicate with the host system or with other guests. For example, you can use virtual hardware in the following ways:

- Have Oracle VM VirtualBox present an ISO CD-ROM image to a guest system as if it were a physical CD-ROM.
- Provide a guest system access to the physical network through its virtual network card.
- Provide the host system, other guests, and computers on the Internet access to the guest system.

Supported Guest Operating Systems

Because Oracle VM VirtualBox is designed to provide a generic virtualization environment for x86 systems, it can run guest operating systems (OSes) of any kind.

The following guest OS platforms are supported:

- **Platforms With Full Support.** These guest OS platforms qualify for Oracle Premier Support. See Table 3-1.
- **Platforms With Limited Support.** These legacy guest OS platforms can be used with Oracle VM VirtualBox, but only qualify for limited support because of the vintage of the technology involved. Therefore, resolution of customer issues for such legacy guest OS platforms cannot be assured. See Table 3-2.

Table 3-1 Guest Operating Systems With Full Support

Operating System	Comments
Windows 11 (64-bit)	Insider preview builds are not supported
Windows 10 (32-bit and 64-bit)	Insider preview builds are not supported
Windows 8 and 8.1 (32-bit and 64-bit)	
Windows Server 2019 (64-bit)	
Windows Server 2016 (64-bit)	
Windows Server 2012 and 2012 R2 (64-bit)	
Solaris 11 (32-bit and 64-bit)	
Solaris 10 8/11 Update 10 and later (32-bit and 64-bit)	
Oracle Linux 9 (64-bit)	Includes Red Hat Enterprise Linux 9, CentOS 9
Oracle Linux 8 (64-bit)	Includes Red Hat Enterprise Linux 8, CentOS 8
Oracle Linux 7 (64-bit)	Includes Red Hat Enterprise Linux 7, CentOS 7

Table 3-1 (Cont.) Guest Operating Systems With Full Support

Operating System	Comments
Oracle Linux 6 (32-bit and 64-bit)	Includes Red Hat Enterprise Linux 6, CentOS 6
Ubuntu 16.04 LTS (Xenial Xerus) (32-bit and 64-bit)	
Ubuntu 18.04 LTS (Bionic Beaver) (64-bit)	
Ubuntu 20.04 LTS (Focal Fossa) (64-bit)	
SUSE Linux Enterprise Server 15 (64-bit)	
SUSE Linux Enterprise Server 12 (64-bit)	

Table 3-2 Legacy Guest Operating Systems With Limited Support

Operating System	Comments
Windows 7 (32-bit and 64-bit)	
Windows Vista SP2 and later (32-bit and 64-bit)	
Windows XP (32-bit)	
Windows Vista (32-bit)	
Windows Server 2008 and 2008 R2 (32-bit and 64-bit)	
Windows Server 2003 (32-bit and 64-bit)	
Oracle Linux 5 (32-bit and 64-bit)	Includes Red Hat Enterprise Linux 5, CentOS 5
Ubuntu 14.04.5 LTS (Trusty Tahr) (32-bit and 64-bit)	
OS/2 Warp 4.5	

Mac OS X Guests

Oracle VM VirtualBox enables you to install and execute unmodified versions of Mac OS X guests on supported host hardware. Note that this feature is experimental and thus unsupported.

Oracle VM VirtualBox is the first product to provide the modern PC architecture expected by OS X without requiring any of the modifications used by competing virtualization solutions. For example, some competing solutions perform modifications to the Mac OS X install DVDs, such as a different boot loader and replaced files.

Be aware of the following important issues before you attempt to install a Mac OS X guest:

- Mac OS X is commercial, licensed software and contains **both license and technical restrictions** that limit its use to certain hardware and usage scenarios. You must understand and comply with these restrictions.

  In particular, Apple prohibits the installation of most versions of Mac OS X on non-Apple hardware.

  These license restrictions are also enforced on a technical level. Mac OS X verifies that it is running on Apple hardware. Most DVDs that accompany Apple hardware check for the exact model. These restrictions are *not* circumvented by Oracle VM VirtualBox and continue to apply.

- Only **CPUs** that are known and tested by Apple are supported. As a result, if your Intel CPU is newer than the Mac OS X build, or if you have a non-Intel CPU, you will likely encounter a panic during bootup with an "Unsupported CPU" exception.

  Ensure that you use the Mac OS X DVD that comes with your Apple hardware.
- The Mac OS X installer expects the hard disk to be *partitioned*. So, the installer will not offer a partition selection to you. Before you can install the software successfully, start the Disk Utility from the Tools menu and partition the hard disk. Close the Disk Utility and proceed with the installation.
- In addition, Mac OS X support in Oracle VM VirtualBox is an experimental feature. See Known Limitations.

64-bit Guests

> **Note:**
>
> Be sure to enable **I/O APIC** for virtual machines that you intend to use in 64-bit mode. This is especially true for 64-bit Windows VMs. See Motherboard Tab. For 64-bit Windows guests, ensure that the VM uses the **Intel networking device** because there is no 64-bit driver support for the AMD PCNet card. See Virtual Networking Hardware.

If you use the **Create VM** wizard of VirtualBox Manager, Oracle VM VirtualBox automatically uses the correct settings for each selected 64-bit OS type. See Creating Your First Virtual Machine.

Unattended Guest Installation

Oracle VM VirtualBox can install a guest OS automatically. You only need to provide the installation medium and a few other parameters, such as the name of the default user.

You can perform an unattended guest installation in the following ways:

- **Use the Create Virtual Machine wizard.** An optional step in the wizard enables you to configure unattended installation. You can specify the default user credentials for the guest OS and also whether to install the Guest Additions automatically. See Creating Your First Virtual Machine.

  During this step, Oracle VM VirtualBox scans the installation medium and changes certain parameters to ensure a seamless installation as a guest running on Oracle VM VirtualBox.
- **Use the `VBoxManage` commands.**Using VBoxManage Commands for Unattended Guest Installation describes how to perform an unattended guest installation for an Oracle Linux guest.

When you first start a VM that has been configured for unattended installation, the guest OS installation is performed automatically.

The installation operation changes the boot device order to boot the virtual hard disk first and then the virtual DVD drive. If the virtual hard disk is empty prior to the automatic installation, the VM boots from the virtual DVD drive and begins the installation.

If the virtual hard disk contains a bootable OS, the installation operation exits. In this case, change the boot device order manually by pressing F12 during the BIOS splash screen.

Using VBoxManage Commands for Unattended Guest Installation

The following example shows how to perform an unattended guest installation for an Oracle Linux VM. The example uses various `VBoxManage` commands to prepare the guest VM. The `VBoxManage unattended install` command is then used to install and configure the guest OS.

1. Create the virtual machine.

```
# VM="ol7-autoinstall"
# VBoxManage list ostypes
# VBoxManage createvm --name $VM --ostype "Oracle_64" --register
```

   Note the following:

   - The $VM variable represents the name of the VM.
   - The `VBoxManage list ostypes` command lists the guest OSes supported by Oracle VM VirtualBox, including the name used for each OS in the `VBoxManage` commands.
   - A 64-bit Oracle Linux 7 VM is created and registered with Oracle VM VirtualBox.
   - The VM has a unique UUID.
   - An XML settings file is generated.

2. Create a virtual hard disk and storage devices for the VM.

```
# VBoxManage createhd --filename /VirtualBox/$VM/$VM.vdi --size 32768
# VBoxManage storagectl $VM --name "SATA Controller" --add sata --controller
IntelAHCI
# VBoxManage storageattach $VM --storagectl "SATA Controller" --port 0 --device 0 \
--type hdd --medium /VirtualBox/$VM/$VM.vdi
# VBoxManage storagectl $VM --name "IDE Controller" --add ide
# VBoxManage storageattach $VM --storagectl "IDE Controller" --port 0 --device 0 \
--type dvddrive --medium /u01/Software/OL/OracleLinux-R7-U6-Server-x86_64-dvd.iso
```

   The previous commands do the following:

   - Create a 32768 MB virtual hard disk.
   - Create a SATA storage controller and attach the virtual hard disk.
   - Create an IDE storage controller for a virtual DVD drive and attach an Oracle Linux installation ISO.

3. (Optional) Configure some settings for the VM.

```
# VBoxManage modifyvm $VM --ioapic on
# VBoxManage modifyvm $VM --boot1 dvd --boot2 disk --boot3 none --boot4 none
# VBoxManage modifyvm $VM --memory 8192 --vram 128
```

   The previous commands do the following:

   - Enable I/O APIC for the motherboard of the VM.
   - Configure the boot device order for the VM.
   - Allocate 8192 MB of RAM and 128 MB of video RAM to the VM.

4. Perform an unattended install of the OS.

```
# VBoxManage unattended install $VM \
--iso=/u01/Software/OL/OracleLinux-R7-U6-Server-x86_64-dvd.iso \
```

```
--user=login --full-user-name=name --password password \
--install-additions --time-zone=CET
```

The previous command does the following:

- Specifies an Oracle Linux ISO as the installation ISO.
- Specifies a login name, full name, and login password for a default user on the guest OS.

  Note that the specified password is also used for the root user account on the guest.
- Installs the Guest Additions on the VM.
- Sets the time zone for the guest OS to Central European Time (CET).

5. Start the virtual machine.

   This step completes the unattended installation process.

   ```
   # VBoxManage startvm $VM --type headless
   ```

   The VM starts in headless mode, which means that the VirtualBox Manager window does not open.

6. (Optional) Update the guest OS to use the latest Oracle Linux packages.

   On the guest VM, run the following command:

   ```
   # yum update
   ```

Emulated Hardware

Oracle VM VirtualBox virtualizes nearly all hardware of the host. Depending on a VM's configuration, the guest will see the following virtual hardware:

- **Input devices.**Oracle VM VirtualBox can emulate a standard PS/2 keyboard and mouse. These devices are supported by most guest OSes.

  In addition, Oracle VM VirtualBox can provide virtual USB input devices to avoid having to capture mouse and keyboard, as described in Capturing and Releasing Keyboard and Mouse.
- **Graphics.** The default Oracle VM VirtualBox graphics device for Windows guests is an SVGA device. For Linux guests, the default graphics device emulates a VMware SVGA graphics device. See Screen Tab.

  For legacy guest OSes, a VGA-compatible graphics device is available.
- **Storage.**Oracle VM VirtualBox emulates the most common types of hard disk controllers. See Hard Disk Controllers. Whereas supporting only one of these controllers would be enough for Oracle VM VirtualBox by itself, this multitude of storage adapters is required for compatibility with other hypervisors. Windows is very selective about its boot devices, and migrating VMs between hypervisors is very difficult or impossible if the storage controllers are different.
- **Networking.** See Virtual Networking Hardware.
- **USB.**Oracle VM VirtualBox emulates these types of USB host controllers: xHCI, EHCI, and OHCI. While xHCI handles all USB transfer speeds, some legacy guest OSes may not support xHCI. Note that for some legacy Windows guests, third party drivers must be installed for xHCI support.

Legacy guest OSes typically support OHCI and EHCI. These two controllers are needed because OHCI only handles USB low-speed and full-speed devices (both USB 1.x and 2.0), while EHCI only handles high-speed devices (USB 2.0 only).

The emulated USB controllers do not communicate directly with devices on the host. Instead they communicate with a virtual USB layer which abstracts the USB protocol and enables the use of remote USB devices.

- **Audio.** See Audio Settings.

General Settings

In the **Settings** window, under **General**, you can configure the most fundamental aspects of the virtual machine such as memory and essential hardware. The following tabs are available.

Basic Tab

In the **Basic** tab of the **General** settings category, you can find these settings:

- **Name:** The name of the the VM, as shown in the list of VMs in the main VirtualBox Manager window. Using this name, Oracle VM VirtualBox also saves the VM's configuration files. If you change the name, Oracle VM VirtualBox renames these files as well. As a result, you can only use characters which are allowed for file names on your host OS.

  Note that internally, Oracle VM VirtualBox uses unique identifiers (UUIDs) to identify virtual machines. You can display these using the `VBoxManage` commands.

- **Type:** The type of the guest OS for the VM. This is the same setting that is specified in the **New Virtual Machine** wizard. See Creating Your First Virtual Machine.

  Whereas the default settings of a newly created VM depend on the selected OS type, changing the type later has no effect on VM settings. This value is purely informational and decorative.

- **Version:** The version of the guest OS for the VM. This is the same setting that is specified in the **New Virtual Machine** wizard. See Creating Your First Virtual Machine.

Advanced Tab

The following settings are available in the **Advanced** tab:

- **Snapshot Folder:** By default, Oracle VM VirtualBox saves snapshot data together with your other Oracle VM VirtualBox configuration data. See Where Oracle VM VirtualBox Stores its Files. With this setting, you can specify any other folder for each VM.

- **Shared Clipboard:** You can select here whether the clipboard of the guest OS should be shared with that of your host. If you select **Bidirectional**, then Oracle VM VirtualBox will always make sure that both clipboards contain the same data. If you select **Host to Guest** or **Guest to Host**, then Oracle VM VirtualBox will only ever copy clipboard data in one direction.

  Clipboard sharing requires that the Oracle VM VirtualBox Guest Additions be installed. In such a case, this setting has no effect. See Guest Additions.

  For security reasons, the shared clipboard is disabled by default. This setting can be changed at any time using the **Shared Clipboard** menu item in the **Devices** menu of the virtual machine.

- **Drag and Drop:** This setting enables support for drag and drop. Select an object, such as a file, from the host or guest and directly copy or open it on the guest or host. Multiple drag and drop modes for a VM enable restricting of access in either direction.

  For drag and drop to work the Guest Additions need to be installed on the guest.

  > **Note:**
  >
  > Drag and drop is disabled by default. This setting can be changed at any time using the **Drag and Drop** menu item in the **Devices** menu of the virtual machine.

  See Drag and Drop.

Description Tab

On the **Description** tab you can enter a description for your virtual machine. This has no effect on the functionality of the machine, but you may find this space useful to note down things such as the configuration of a virtual machine and the software that has been installed into it.

To insert a line break into the **Description** text field, press Shift+Enter.

Disk Encryption Tab

The **Disk Encryption** tab enables you to encrypt disks that are attached to the virtual machine.

To enable disk encryption, select the **Enable Disk Encryption** check box.

Settings are available to configure the cipher used for encryption and the encryption password.

> **Note:**
>
> All files related to the virtual machine except disk images are stored unencrypted. To encrypt these files, use the `VBoxManage encryptvm` command as described in Encryption of VMs.

System Settings

The **System** category groups various settings that are related to the basic hardware that is presented to the virtual machine.

> **Note:**
>
> As the activation mechanism of Microsoft Windows is sensitive to hardware changes, if you are changing hardware settings for a Windows guest, some of these changes may trigger a request for another activation with Microsoft.

The following tabs are available.

Motherboard Tab

On the **Motherboard** tab, you can configure virtual hardware that would normally be on the motherboard of a real computer.

- **Base Memory:** Sets the amount of RAM that is allocated and given to the VM when it is running. The specified amount of memory will be requested from the host OS, so it must be available or made available as free memory on the host when attempting to start the VM and will not be available to the host while the VM is running. This is the same setting that was specified in the **New Virtual Machine** wizard, as described in Creating Your First Virtual Machine.

  Generally, it is possible to change the memory size after installing the guest OS. But you must not reduce the memory to an amount where the OS would no longer boot.

- **Boot Order:** Determines the order in which the guest OS will attempt to boot from the various virtual boot devices. Analogous to a real PC's BIOS setting, Oracle VM VirtualBox can tell a guest OS to start from the virtual floppy, the virtual CD/DVD drive, the virtual hard drive (each of these as defined by the other VM settings), the network, or none of these.

  If you select **Network**, the VM will attempt to boot from a network using the PXE mechanism. This needs to be configured in detail on the command line. See VBoxManage modifyvm.

- **Chipset:** You can select which chipset will be presented to the virtual machine. PIIX3 is the default chipset for most guests. For some guest OSes such as Mac OS X, the PIIX3 chipset is not well supported. As a result, Oracle VM VirtualBox supports an emulation of the ICH9 chipset, which supports PCI express, three PCI buses, PCI-to-PCI bridges and Message Signaled Interrupts (MSI). This enables modern OSes to address more PCI devices and no longer requires IRQ sharing. Using the ICH9 chipset it is also possible to configure up to 36 network cards, compared to a maximum of eight network adapters with PIIX3. Note that ICH9 support is experimental and not recommended for guest OSes which do not require it.

- **TPM:** Enables support for a Trusted Platform Module (TPM) security processor. Choose from the supported TPM versions.

- **Pointing Device:** The default virtual pointing device for some guest OSes is the traditional PS/2 mouse. If set to **USB Tablet**, Oracle VM VirtualBox reports to the virtual machine that a USB tablet device is present and communicates mouse events to the virtual machine through this device. Another setting is **USB Multi-Touch Tablet**, which is suitable for guests running Windows 8 or later.

  Using the virtual USB tablet has the advantage that movements are reported in absolute coordinates, instead of as relative position changes. This enables Oracle VM VirtualBox to translate mouse events over the VM window into tablet events without having to "capture" the mouse in the guest as described in Capturing and Releasing Keyboard and Mouse. This makes using the VM less tedious even if Guest Additions are not installed.

- **Enable I/O APIC:** Advanced Programmable Interrupt Controllers (APICs) are an x86 hardware feature that have replaced Programmable Interrupt Controllers (PICs). With an I/O APIC, OSes can use more than 16 interrupt requests (IRQs) and therefore avoid IRQ sharing for improved reliability.

> **Note:**
>
> Enabling the I/O APIC is *required*, especially for 64-bit Windows guest OSes. It is also required if you want to use more than one virtual CPU in a virtual machine.

However, software support for I/O APICs has been unreliable with some OSes other than Windows. Also, the use of an I/O APIC slightly increases the overhead of virtualization and therefore slows down the guest OS a little.

> **Note:**
>
> All Windows OSes install different kernels, depending on whether an I/O APIC is available. As with ACPI, the I/O APIC therefore *must not be turned off after installation* of a Windows guest OS. Turning it on after installation will have no effect however.

- **Hardware Clock in UTC Time:** If selected, Oracle VM VirtualBox will report the system time in UTC format to the guest instead of the local (host) time. This affects how the virtual real-time clock (RTC) operates and may be useful for UNIX-like guest OSes, which typically expect the hardware clock to be set to UTC.
- **Enable EFI:** Enables Extensible Firmware Interface (EFI), which replaces the legacy BIOS and may be useful for certain advanced use cases. See Alternative Firmware (EFI).
- **Enable Secure Boot:** Enables Secure Boot, to provide a secure environment for starting the guest OS.

In addition, you can turn off the **Advanced Configuration and Power Interface (ACPI)** which Oracle VM VirtualBox presents to the guest OS by default.

ACPI is the current industry standard to allow OSes to recognize hardware, configure motherboards and other devices and manage power. As most computers contain this feature and Windows and Linux support ACPI, it is also enabled by default in Oracle VM VirtualBox. ACPI can only be turned off using the command line. See VBoxManage modifyvm.

> **Note:**
>
> All Windows OSes install different kernels, depending on whether ACPI is available. This means that ACPI *must not be turned off* after installation of a Windows guest OS. However, turning it on after installation will have no effect.

Processor Tab

On the **Processor** tab, you can configure settings for the CPU used by the virtual machine.

- **Processor(s):** Sets the number of virtual CPU cores the guest OSes can see. Oracle VM VirtualBox supports symmetrical multiprocessing (SMP) and can present up to 32 virtual CPU cores to each virtual machine.

  You should not configure virtual machines to use more CPU cores than are available physically. This includes real cores, with no hyperthreads.

- **Execution Cap:** Configures the CPU execution cap. This limits the amount of time a host CPU spends to emulate a virtual CPU. The default setting is 100%, meaning that there is no limitation. A setting of 50% implies a single virtual CPU can use up to 50% of a single host CPU. Note that limiting the execution time of the virtual CPUs may cause guest timing problems.

  A warning is displayed at the bottom of the Processor tab if an Execution Cap setting is made that may affect system performance.

- **Enable PAE/NX:** Determines whether the PAE and NX capabilities of the host CPU will be exposed to the virtual machine.

  PAE stands for Physical Address Extension. Normally, if enabled and supported by the OS, then even a 32-bit x86 CPU can access more than 4 GB of RAM. This is made possible by adding another 4 bits to memory addresses, so that with 36 bits, up to 64 GB can be addressed. Some OSes, such as Ubuntu Server, require PAE support from the CPU and cannot be run in a virtual machine without it.

- **Enable Nested VT-x/AMD-V**: Enables nested virtualization, with passthrough of hardware virtualization functions to the guest VM.

With virtual machines running modern server OSes, Oracle VM VirtualBox also supports CPU hot-plugging. For details, see CPU Hot-Plugging.

Acceleration Tab

On this tab, you can configure Oracle VM VirtualBox to use hardware virtualization extensions that your host CPU supports.

- **Paravirtualization Interface:**Oracle VM VirtualBox provides paravirtualization interfaces to improve time-keeping accuracy and performance of guest OSes. The options available are documented under the `--paravirt-provider` option in VBoxManage modifyvm. For further details on the paravirtualization providers, see Paravirtualization Providers.

- **Hardware Virtualization:** You can configure hardware virtualization features for each virtual machine.

  – **Enable Nested Paging:** If the host CPU supports the nested paging (AMD-V) or EPT (Intel VT-x) features, then you can expect a significant performance increase by enabling nested paging in addition to hardware virtualization. For technical details, see Nested Paging and VPIDs. For Intel EPT security recommendations, see CVE-2018-3646.

  Advanced users may be interested in technical details about hardware virtualization. See Hardware Virtualization.

In most cases, the default settings on the **Acceleration** tab will work well. Oracle VM VirtualBox selects sensible defaults, depending on the OS that you selected when you created the virtual machine. In certain situations, however, you may want to change the preconfigured defaults.

Display Settings

The following tabs are available for configuring the display for a virtual machine.

Screen Tab

- **Video Memory:** Sets the size of the memory provided by the virtual graphics card available to the guest, in MB. As with the main memory, the specified amount will be

allocated from the host's resident memory. Based on the amount of video memory, higher resolutions and color depths may be available.

VirtualBox Manager will show a warning if the amount of video memory is too small to be able to switch the VM into full screen mode. The minimum value depends on the number of virtual monitors, the screen resolution and the color depth of the host display as well as on the use of *3D acceleration* and *2D video acceleration*. A rough estimate is (*color depth* / 8) x *vertical pixels* x *horizontal pixels* x *number of screens* = *number of bytes*. Extra memory may be required if display acceleration is used.

- **Monitor Count:** With this setting, Oracle VM VirtualBox can provide more than one virtual monitor to a virtual machine. If a guest OS supports multiple attached monitors, Oracle VM VirtualBox can pretend that multiple virtual monitors are present. Up to eight such virtual monitors are supported.

  The output of the multiple monitors are displayed on the host in multiple VM windows which are running side by side. However, in full screen and seamless mode, they use the available physical monitors attached to the host. As a result, for full screen and seamless modes to work with multiple monitors, you will need at least as many physical monitors as you have virtual monitors configured, or Oracle VM VirtualBox will report an error.

  You can configure the relationship between guest and host monitors using the **View** menu by pressing Host key + Home when you are in full screen or seamless mode.

  See also Known Limitations.

- **Scale Factor:** Enables scaling of the display size. For multiple monitor displays, you can set the scale factor for individual monitors, or globally for all of the monitors. Use the slider to select a scaling factor up to 200%.

  You can set a default scale factor for all VMs. Use the **Display** tab in the Preferences window.

- **Graphics Controller:** Specifies the graphics adapter type used by the guest VM. Note that you must install the Guest Additions on the guest VM to specify the VBoxSVGA or VMSVGA graphics controller. The following options are available:

  - **VBoxSVGA:** The default graphics controller for new VMs that use Windows 7 or later.

    This graphics controller improves performance and 3D support when compared to the legacy VBoxVGA option.

  - **VBoxVGA:** Use this graphics controller for legacy guest OSes. This is the default graphics controller for Windows versions before Windows 7 and for Oracle Solaris.

    3D acceleration is not supported for this graphics controller.

  - **VMSVGA:** Use this graphics controller to emulate a VMware SVGA graphics device. This is the default graphics controller for Linux guests.

  - **None:** Does not emulate a graphics adapter type.

- **Enable 3D Acceleration:** If a virtual machine has Guest Additions installed, you can select here whether the guest should support accelerated 3D graphics. See Hardware 3D Acceleration (OpenGL and Direct3D 8/9).

Remote Display Tab

On the **Remote Display** tab, if the VirtualBox Remote Display Extension (VRDE) is installed, you can enable the VRDP server that is built into Oracle VM VirtualBox. This enables you to connect to the console of the virtual machine remotely with any standard RDP viewer, such as `mstsc.exe` that comes with Microsoft Windows. On Linux and Oracle Solaris systems you

can use the standard open source `rdesktop` program. These features are described in Remote Display (VRDP Support).

- **Enable Server:** Select this check box and configure settings for the remote display connection.

Recording Tab

On the **Recording** tab you can enable video and audio recording for a virtual machine and change related settings. Note that these features can be enabled and disabled while a VM is running.

- **Enable Recording:** Select this check box and select a **Recording Mode** option.
- **Recording Mode:** You can choose to record video, audio, or both video and audio.

  Some settings on the **Recording** tab may be grayed out, depending on the **Recording Mode** setting.
- **File Path:** The file where the recording is saved.
- **Frame Size:** The video resolution of the recorded video, in pixels. The drop-down list enables you to select from common frame sizes.
- **Frame Rate:** Use the slider to set the maximum number of video frames per second (FPS) to record. Frames that have a higher frequency are skipped. Increasing this value reduces the number of skipped frames and increases the file size.
- **Video Quality:** Use the slider to set the the bit rate of the video in kilobits per second. Increasing this value improves the appearance of the video at the cost of an increased file size.
- **Audio Quality:** Use the slider to set the quality of the audio recording. Increasing this value improves the audio quality at the cost of an increased file size.
- **Screens:** For a multiple monitor display, you can select which screens to record video from.

As you adjust the video and audio recording settings, the approximate output file size for a five minute video is shown.

Storage Settings

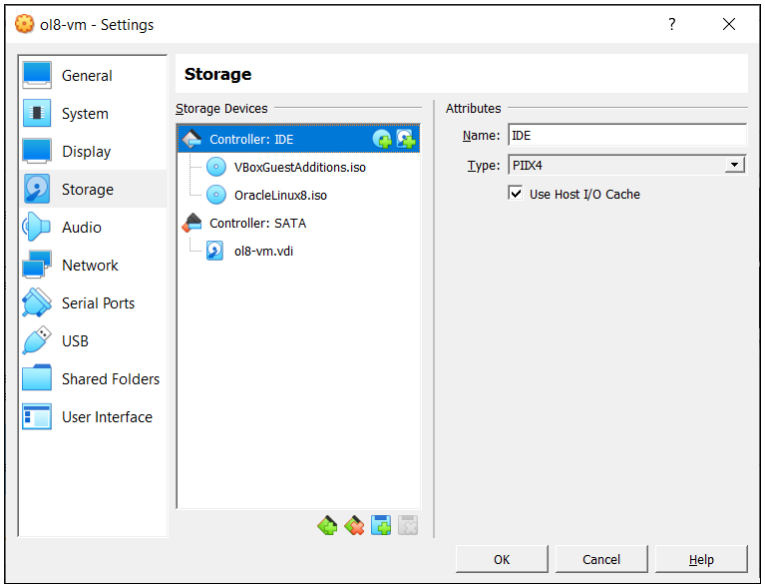
The **Storage** category in the VM settings enables you to connect virtual hard disk, CD/DVD, and floppy images and drives to your virtual machine.

In a real computer, so-called *storage controllers* connect physical disk drives to the rest of the computer. Similarly, Oracle VM VirtualBox presents virtual storage controllers to a virtual machine. Under each controller, the virtual devices, such as hard disks, CD/DVD or floppy drives, attached to the controller are shown.

> **Note:**
>
> This section gives a quick introduction to the Oracle VM VirtualBox storage settings. See Virtual Storage for a full description of the available storage settings in Oracle VM VirtualBox.

If you have used the **Create Virtual Machine** wizard to create a machine, you will normally see something like the following:

Figure 3-1 Storage Settings for a Virtual Machine



Depending on the guest OS type that you selected when you created the VM, a new VM includes the following storage devices:

- **IDE controller.** A virtual CD/DVD drive is attached to device 0 on the secondary channel of the IDE controller.
- **SATA controller.** This is a modern type of storage controller for higher hard disk data throughput, to which the virtual hard disks are attached. Initially you will normally have one such virtual disk, but as shown in the previous screenshot, you can have more than one. Each is represented by a disk image file, such as a VDI file in this example.

If you created your VM with an older version of Oracle VM VirtualBox, the default storage layout may differ. You might then only have an IDE controller to which both the CD/DVD drive and the hard disks have been attached. This might also apply if you selected an older OS type when you created the VM. Since older OSes do not support SATA without additional drivers, Oracle VM VirtualBox will make sure that no such devices are present initially. See Hard Disk Controllers.

Oracle VM VirtualBox also provides a *floppy controller*. You cannot add devices other than floppy drives to this controller. Virtual floppy drives, like virtual CD/DVD drives, can be connected to either a host floppy drive, if you have one, or a disk image, which in this case must be in RAW format.

You can modify these media attachments freely. For example, if you wish to copy some files from another virtual disk that you created, you can connect that disk as a second hard disk, as in the above screenshot. You could also add a second virtual CD/DVD drive, or change where these items are attached. The following options are available:

- To **add another virtual hard disk, or a CD/DVD or floppy drive**, select the storage controller to which it should be added (such as IDE, SATA, SCSI, SAS, floppy controller) and then click the **Add Disk** button below the tree. You can then either select **Optical Drive** or **Hard Disk**. If you clicked on a floppy controller, you can add a floppy drive instead. Alternatively, right-click on the storage controller and select a menu item there.

A dialog is displayed, enabling you to select an existing disk image file or to create a new disk image file. Depending on the type of disk image, the dialog is called **Hard Disk Selector**, **Optical Disk Selector**, or **Floppy Disk Selector**.

See Disk Image Files (VDI, VMDK, VHD, HDD) for information on the image file types that are supported by Oracle VM VirtualBox.

For virtual CD/DVD drives, the image files will typically be in the standard ISO format instead. Most commonly, you will select this option when installing an OS from an ISO file that you have obtained from the Internet. For example, most Linux distributions are available in this way.

Depending on the type of disk image, you can set the following **Attributes** for the disk image in the right part of the Storage settings page:

- The **device slot** of the controller that the virtual disk is connected to. IDE controllers have four slots: primary device 0, primary device 1, secondary device 0, and secondary device 1. By contrast, SATA and SCSI controllers offer you up to 30 slots for attaching virtual devices.
- **Solid-state Drive** presents a virtual disk to the guest as a solid-state device.
- **Hot-pluggable** presents a virtual disk to the guest as a hot-pluggable device.
- For virtual CD/DVD drives, you can select **Live CD/DVD**. This means that the virtual optical disk is not removed from when the guest system ejects it.

- To **remove an attachment**, either select it and click on the **Remove** icon at the bottom, or right-click on it and select the menu item.

Removable media, such as CD/DVDs and floppies, can be changed while the guest is running. Since the **Settings** window is not available at that time, you can also access these settings from the **Devices** menu of your virtual machine window.

Audio Settings

The **Audio** section in a virtual machine's **Settings** window determines whether the VM will detect a connected sound card, and if the audio output should be played on the host system.

To enable audio for a guest, select the **Enable Audio** check box. The following settings are available:

- **Host Audio Driver:** The audio driver that Oracle VM VirtualBox uses on the host.

  The **Default** option is enabled by default for all new VMs. This option selects the best audio driver for the host platform automatically. This enables you to move VMs between different platforms without having to change the audio driver.

  On a Linux host, depending on your host configuration, you can select between the OSS, ALSA, or the PulseAudio subsystem. On newer Linux distributions, the PulseAudio subsystem is preferred.

  Only OSS is supported on Oracle Solaris hosts. The Oracle Solaris Audio audio backend is no longer supported on Oracle Solaris hosts.

- **Audio Controller:** You can choose between the emulation of an Intel AC'97 controller, an Intel HD Audio controller, or a SoundBlaster 16 card.
- **Enable Audio Output:** Enables audio output only for the VM.
- **Enable Audio Input:** Enables audio input only for the VM.

Network Settings

The **Network** section in a virtual machine's **Settings** window enables you to configure how Oracle VM VirtualBox presents virtual network cards to your VM, and how they operate.

When you first create a virtual machine, Oracle VM VirtualBox by default enables one virtual network card and selects the Network Address Translation (NAT) mode for it. This way the guest can connect to the outside world using the host's networking and the outside world can connect to services on the guest which you choose to make visible outside of the virtual machine.

This default setup is good for the majority of Oracle VM VirtualBox users. However, Oracle VM VirtualBox is extremely flexible in how it can virtualize networking. It supports many virtual network cards per virtual machine. The first four virtual network cards can be configured in detail in VirtualBox Manager. Additional network cards can be configured using the `VBoxManage` command.

Many networking options are available. See Virtual Networking for more information.

Serial Ports

Oracle VM VirtualBox supports the use of virtual serial ports in a virtual machine.

Ever since the original IBM PC, personal computers have been equipped with one or two serial ports, also called COM ports by DOS and Windows. Serial ports were commonly used with modems, and some computer mice used to be connected to serial ports before USB became commonplace.

While serial ports are no longer as common as they used to be, there are still some important uses left for them. For example, serial ports can be used to set up a primitive network over a null-modem cable, in case Ethernet is not available. Also, serial ports are indispensable for system programmers needing to do kernel debugging, since kernel debugging software usually interacts with developers over a serial port. With virtual serial ports, system programmers can do kernel debugging on a virtual machine instead of needing a real computer to connect to.

If a virtual serial port is enabled, the guest OS sees a standard 16550A compatible UART device. Other UART types can be configured using the `VBoxManage modifyvm` command. Both receiving and transmitting data is supported. How this virtual serial port is then connected to the host is configurable, and the details depend on your host OS.

You can use either the Settings tabs or the `VBoxManage` command to set up virtual serial ports. For the latter, see VBoxManage modifyvm for information on the `--uart`, `--uart-mode` and `--uart-type` options.

You can configure up to four virtual serial ports per virtual machine. For each device, you must set the following:

1. **Port Number:** This determines the serial port that the virtual machine should see. For best results, use the traditional values as follows:
   - COM1: I/O base 0x3F8, IRQ 4
   - COM2: I/O base 0x2F8, IRQ 3
   - COM3: I/O base 0x3E8, IRQ 4
   - COM4: I/O base 0x2E8, IRQ 3

You can also configure a user-defined serial port. Enter an I/O base address and interrupt (IRQ).

2. **Port Mode:** What the virtual port is connected to. For each virtual serial port, you have the following options:

   - **Disconnected:** The guest will see the device, but it will behave as if no cable had been connected to it.
   - **Host Device:** Connects the virtual serial port to a physical serial port on your host. On a Windows host, this will be a name like `COM1`. On Linux or Oracle Solaris hosts, it will be a device node like `/dev/ttyS0`. Oracle VM VirtualBox will then simply redirect all data received from and sent to the virtual serial port to the physical device.
   - **Host Pipe:** Configure Oracle VM VirtualBox to connect the virtual serial port to a software pipe on the host. This depends on your host OS, as follows:
     - On a Windows host, data will be sent and received through a named pipe. The pipe name must be in the format `\\.\pipe\`*`name`* where *name* should identify the virtual machine but may be freely chosen.
     - On a Mac OS, Linux, or Oracle Solaris host, a local domain socket is used instead. The socket filename must be chosen such that the user running Oracle VM VirtualBox has sufficient privileges to create and write to it. The `/tmp` directory is often a good candidate.

       On Linux there are various tools which can connect to a local domain socket or create one in server mode. The most flexible tool is `socat` and is available as part of many distributions.

     In this case, you can configure whether Oracle VM VirtualBox should create the named pipe, or the local domain socket non-Windows hosts, itself or whether Oracle VM VirtualBox should assume that the pipe or socket exists already. With the `VBoxManage` command-line options, this is referred to as server mode or client mode, respectively.

     For a direct connection between two virtual machines, corresponding to a null-modem cable, simply configure one VM to create a pipe or socket and another to attach to it.
   - **Raw File:** Send the virtual serial port output to a file. This option is very useful for capturing diagnostic output from a guest. Any file may be used for this purpose, as long as the user running Oracle VM VirtualBox has sufficient privileges to create and write to the file.
   - **TCP:** Useful for forwarding serial traffic over TCP/IP, acting as a server, or it can act as a TCP client connecting to other servers. This option enables a remote machine to directly connect to the guest's serial port using TCP.
     - **TCP Server:** Deselect the **Connect to Existing Pipe/Socket** check box and specify the port number in the **Path/Address** field. This is typically 23 or 2023. Note that on UNIX-like systems you will have to use a port a number greater than 1024 for regular users.

       The client can use software such as `PuTTY` or the `telnet` command line tool to access the TCP Server.
     - **TCP Client:** To create a virtual null-modem cable over the Internet or LAN, the other side can connect using TCP by specifying *`hostname`*`:`*`port`* in the **Path/Address** field. The TCP socket will act in client mode if you select the **Connect to Existing Pipe/Socket** check box.

Up to four serial ports can be configured per virtual machine, but you can pick any port numbers out of the above. However, serial ports cannot reliably share interrupts. If both ports

are to be used at the same time, they must use different interrupt levels, for example COM1 and COM2, but not COM1 and COM3.

USB Support

USB Settings

The **USB** section in a virtual machine's **Settings** window enables you to configure Oracle VM VirtualBox's sophisticated USB support.

Oracle VM VirtualBox can enable virtual machines to access the USB devices on your host directly. To achieve this, Oracle VM VirtualBox presents the guest OS with a virtual USB controller. As soon as the guest system starts using a USB device, it will appear as unavailable on the host.

> **Note:**
>
> - Be careful with USB devices that are currently in use on the host. For example, if you allow your guest to connect to your USB hard disk that is currently mounted on the host, when the guest is activated, it will be disconnected from the host without a proper shutdown. This may cause data loss.
> - Oracle Solaris hosts have a few known limitations regarding USB support. See Known Limitations.

In addition to allowing a guest access to your local USB devices, Oracle VM VirtualBox even enables your guests to connect to remote USB devices by use of the VirtualBox Remote Desktop Extension (VRDE). See Remote USB.

To enable USB for a VM, select the **Enable USB Controller** check box. The following settings are available:

- **USB Controller:** Selects a controller with the specified level of USB support, as follows:
  - OHCI for USB 1.1
  - EHCI for USB 2.0. This also enables OHCI.
  - xHCI for USB 3.0. This supports all USB speeds.
- **USB Device Filters:** When USB support is enabled for a VM, you can determine in detail which devices will be automatically attached to the guest. For this, you can create filters by specifying certain properties of the USB device. USB devices with a matching filter will be automatically passed to the guest once they are attached to the host. USB devices without a matching filter can be passed manually to the guest, for example by using the **Devices**, **USB** menu.

  Clicking on the **+** button to the right of the **USB Device Filters** window creates a new filter. You can give the filter a name, for later reference, and specify the filter criteria. The more criteria you specify, the more precisely devices will be selected. For instance, if you specify only a vendor ID of 046d, all devices produced by Logitech will be available to the guest. If you fill in all fields, on the other hand, the filter will only apply to a particular device model from a particular vendor, and not even to other devices of the same type with a different revision and serial number.

  In detail, the following criteria are available:

- **Vendor and Product ID.** With USB, each vendor of USB products carries an identification number that is unique world-wide, called the *vendor ID*. Similarly, each line of products is assigned a *product ID* number. Both numbers are commonly written in hexadecimal, and a colon separates the vendor from the product ID. For example, `046d:c016` stands for Logitech as a vendor, and the M-UV69a Optical Wheel Mouse product.

  Alternatively, you can also specify **Manufacturer** and **Product** by name.

  To list all the USB devices that are connected to your host machine with their respective vendor IDs and product IDs, use the following command:

  ```
  VBoxManage list usbhost
  ```

  On Windows, you can also see all USB devices that are attached to your system in the Device Manager. On Linux, you can use the `lsusb` command.

- **Serial Number.** While vendor ID and product ID are quite specific to identify USB devices, if you have two identical devices of the same brand and product line, you will also need their serial numbers to filter them out correctly.

- **Remote.** This setting specifies whether the device will be local only, remote only, such as over VRDP, or either.

On a Windows host, you will need to unplug and reconnect a USB device to use it after creating a filter for it.

As an example, you could create a new USB filter and specify a vendor ID of 046d for Logitech, Inc, a manufacturer index of 1, and "not remote". Then any USB devices on the host system produced by Logitech, Inc with a manufacturer index of 1 will be visible to the guest system.

Several filters can select a single device. For example, a filter which selects all Logitech devices, and one which selects a particular webcam.

You can deactivate filters without deleting them by deselecting the check box next to the filter name.

Implementation Notes for Windows and Linux Hosts

On Windows hosts, a kernel mode device driver provides USB proxy support. It implements both a USB monitor, which enables Oracle VM VirtualBox to capture devices when they are plugged in, and a USB device driver to claim USB devices for a particular virtual machine. System reboots are not necessary after installing the driver. Also, you do not need to replug devices for Oracle VM VirtualBox to claim them.

On supported Linux hosts, Oracle VM VirtualBox accesses USB devices through special files in the file system. When Oracle VM VirtualBox is installed, these are made available to all users in the `vboxusers` system group. In order to be able to access USB from guest systems, make sure that you are a member of this group.

Shared Folders

Shared folders enable you to easily exchange data between a virtual machine and your host. This feature requires that the Oracle VM VirtualBox Guest Additions be installed in a virtual machine and is described in detail in Shared Folders.

User Interface

The **User Interface** section enables you to change certain aspects of the user interface of the selected VM.

- **Menu Bar:** This widget enables you to disable a complete menu, by clicking on the menu name to deselect it. Menu entries can be disabled, by deselecting the check box next to the entry. On Windows and Linux hosts, the complete menu bar can be disabled by deselecting the check box on the right.
- **Mini ToolBar:** In full screen or seamless mode, Oracle VM VirtualBox can display a small toolbar that contains some of the items that are normally available from the virtual machine's menu bar. This toolbar reduces itself to a small gray line unless you move the mouse over it. With the toolbar, you can return from full screen or seamless mode, control machine execution, or enable certain devices. If you do not want to see the toolbar, disable the **Show in Full Screen/Seamless** setting.

  The **Show at Top of Screen** setting enables you to show the toolbar at the top of the screen, instead of showing it at the bottom.

  The Mini Toolbar is not available on macOS hosts.
- **Status Bar:** This widget enables you to disable and reorder icons on the status bar. Deselect the check box of an icon to disable it, or rearrange icons by dragging and dropping the icon. To disable the complete status bar deselect the check box on the left.

Alternative Firmware (EFI)

Oracle VM VirtualBox includes experimental support for the Extensible Firmware Interface (EFI), which is an industry standard intended to replace the legacy BIOS as the primary interface for bootstrapping computers and certain system services later.

By default, Oracle VM VirtualBox uses the BIOS firmware for virtual machines. To use EFI for a given virtual machine, you can enable EFI in the machine's **Settings** window. See Motherboard Tab. Alternatively, use the `VBoxManage` command line interface as follows:

```
VBoxManage modifyvm "VM name" --firmware efi
```

To switch back to using the BIOS:

```
VBoxManage modifyvm "VM name" --firmware bios
```

One notable user of EFI is Apple Mac OS X. More recent Linux versions and Windows releases, starting with Vista, also offer special versions that can be booted using EFI.

Another possible use of EFI in Oracle VM VirtualBox is development and testing of EFI applications, without booting any OS.

Note that the Oracle VM VirtualBox EFI support is experimental and will be enhanced as EFI matures and becomes more widespread. Mac OS X, Linux, and newer Windows guests are known to work fine. Windows 7 guests are unable to boot with the Oracle VM VirtualBox EFI implementation.

Video Modes in EFI

EFI provides two distinct video interfaces: GOP (Graphics Output Protocol) and UGA (Universal Graphics Adapter). Modern OSes, such as Mac OS X, generally use GOP, while

some older ones still use UGA. Oracle VM VirtualBox provides a configuration option to control the graphics resolution for both interfaces, making the difference mostly irrelevant for users.

The default resolution is 1024x768. To select a graphics resolution for EFI, use the following `VBoxManage` command:

```
VBoxManage setextradata "VM name" VBoxInternal2/EfiGraphicsResolution HxV
```

Determine the horizontal resolution H and the vertical resolution V from the following list of default resolutions:

VGA
640x480, 32bpp, 4:3

SVGA
800x600, 32bpp, 4:3

XGA
1024x768, 32bpp, 4:3

XGA+
1152x864, 32bpp, 4:3

HD
1280x720, 32bpp, 16:9

WXGA
1280x800, 32bpp, 16:10

SXGA
1280x1024, 32bpp, 5:4

SXGA+
1400x1050, 32bpp, 4:3

WXGA+
1440x900, 32bpp, 16:10

HD+
1600x900, 32bpp, 16:9

UXGA
1600x1200, 32bpp, 4:3

WSXGA+
1680x1050, 32bpp, 16:10

Full HD
1920x1080, 32bpp, 16:9

WUXGA
1920x1200, 32bpp, 16:10

DCI 2K
2048x1080, 32bpp, 19:10

Full HD+
2160x1440, 32bpp, 3:2

Unnamed
2304x1440, 32bpp, 16:10

QHD
2560x1440, 32bpp, 16:9

WQXGA
2560x1600, 32bpp, 16:10

QWXGA+
2880x1800, 32bpp, 16:10

QHD+
3200x1800, 32bpp, 16:9

WQSXGA
3200x2048, 32bpp, 16:10

4K UHD
3840x2160, 32bpp, 16:9

WQUXGA
3840x2400, 32bpp, 16:10

DCI 4K
4096x2160, 32bpp, 19:10

HXGA
4096x3072, 32bpp, 4:3

UHD+
5120x2880, 32bpp, 16:9

WHXGA
5120x3200, 32bpp, 16:10

WHSXGA
6400x4096, 32bpp, 16:10

HUXGA
6400x4800, 32bpp, 4:3

8K UHD2
7680x4320, 32bpp, 16:9

If this list of default resolution does not cover your needs, see Custom VESA Resolutions. Note that the color depth value specified in a custom video mode must be specified. Color depths of 8, 16, 24, and 32 are accepted. EFI assumes a color depth of 32 by default.

The EFI default video resolution settings can only be changed when the VM is powered off.

Specifying Boot Arguments

It is currently not possible to manipulate EFI variables from within a running guest. For example, setting the `boot-args` variable by running the `nvram` tool in a Mac OS X guest will not work. As an alternative method, `VBoxInternal2/EfiBootArgs` extradata can be passed to a VM in order to set the `boot-args` variable. To change the `boot-args` EFI variable, use the following command:

```
VBoxManage setextradata "VM name" VBoxInternal2/EfiBootArgs <value>
```

4
Guest Additions

The previous chapter covered getting started with Oracle VM VirtualBox and installing operating systems in a virtual machine. For any serious and interactive use, the Oracle VM VirtualBox Guest Additions will make your life much easier by providing closer integration between host and guest and improving the interactive performance of guest systems. This chapter describes the Guest Additions in detail.

Introduction to Guest Additions

As mentioned in Some Terminology, the Guest Additions are designed to be installed *inside* a virtual machine after the guest operating system has been installed. They consist of device drivers and system applications that optimize the guest operating system for better performance and usability. See Supported Guest Operating Systems for details on what guest operating systems are fully supported with Guest Additions by Oracle VM VirtualBox.

The Oracle VM VirtualBox Guest Additions for all supported guest operating systems are provided as a single CD-ROM image file which is called `VBoxGuestAdditions.iso`. This image file is located in the installation directory of Oracle VM VirtualBox. To install the Guest Additions for a particular VM, you mount this ISO file in your VM as a virtual CD-ROM and install from there.

The Guest Additions offer the following features:

- **Mouse pointer integration**. To overcome the limitations for mouse support described in Capturing and Releasing Keyboard and Mouse, this feature provides you with seamless mouse support. You will only have one mouse pointer and pressing the Host key is no longer required to *free* the mouse from being captured by the guest OS. To make this work, a special mouse driver is installed in the guest that communicates with the physical mouse driver on your host and moves the guest mouse pointer accordingly.
- **Shared folders.** These provide an easy way to exchange files between the host and the guest. Much like ordinary Windows network shares, you can tell Oracle VM VirtualBox to treat a certain host directory as a shared folder, and Oracle VM VirtualBox will make it available to the guest operating system as a network share, irrespective of whether the guest actually has a network. See Shared Folders.
- **Better video support.** While the virtual graphics card which Oracle VM VirtualBox emulates for any guest operating system provides all the basic features, the custom video drivers that are installed with the Guest Additions provide you with extra high and non-standard video modes, as well as accelerated video performance.

  In addition, with Windows, Linux, and Oracle Solaris guests, you can resize the virtual machine's window if the Guest Additions are installed. The video resolution in the guest will be automatically adjusted, as if you had manually entered an arbitrary resolution in the guest's **Display** settings. See Resizing the Machine's Window.

  If the Guest Additions are installed, 3D graphics and 2D video for guest applications can be accelerated. See Hardware-Accelerated Graphics.
- **Seamless windows.** With this feature, the individual windows that are displayed on the desktop of the virtual machine can be mapped on the host's desktop, as if the underlying application was actually running on the host. See Seamless Windows.

- **Generic host/guest communication channels.** The Guest Additions enable you to control and monitor guest execution. The *guest properties* provide a generic string-based mechanism to exchange data bits between a guest and a host, some of which have special meanings for controlling and monitoring the guest. See Guest Properties.

  Additionally, applications can be started in a guest from the host. See Guest Control of Applications.

- **Time synchronization.** With the Guest Additions installed, Oracle VM VirtualBox can ensure that the guest's system time is better synchronized with that of the host.

  For various reasons, the time in the guest might run at a slightly different rate than the time on the host. The host could be receiving updates through NTP and its own time might not run linearly. A VM could also be paused, which stops the flow of time in the guest for a shorter or longer period of time. When the wall clock time between the guest and host only differs slightly, the time synchronization service attempts to gradually and smoothly adjust the guest time in small increments to either catch up or lose time. When the difference is too great, for example if a VM paused for hours or restored from saved state, the guest time is changed immediately, without a gradual adjustment.

  The Guest Additions will resynchronize the time regularly. See Tuning the Guest Additions Time Synchronization Parameters for how to configure the parameters of the time synchronization mechanism.

- **Shared clipboard.** With the Guest Additions installed, the clipboard of the guest operating system can optionally be shared with your host operating system. See General Settings.

- **Automated logins.** Also called credentials passing. See Automated Guest Logins.

Each version of Oracle VM VirtualBox, even minor releases, ship with their own version of the Guest Additions. While the interfaces through which the Oracle VM VirtualBox core communicates with the Guest Additions are kept stable so that Guest Additions already installed in a VM should continue to work when Oracle VM VirtualBox is upgraded on the host, for best results, it is recommended to keep the Guest Additions at the same version.

The Windows and Linux Guest Additions therefore check automatically whether they have to be updated. If the host is running a newer Oracle VM VirtualBox version than the Guest Additions, a notification with further instructions is displayed in the guest.

To disable this update check for the Guest Additions of a given virtual machine, set the value of its `/VirtualBox/GuestAdd/CheckHostVersion` guest property to `0`. See Guest Properties.

Installing and Maintaining Guest Additions

Guest Additions are available for virtual machines running Windows, Linux, Oracle Solaris, or OS/2. The following sections describe the specifics of each variant in detail.

Guest Additions for Windows

The Oracle VM VirtualBox Windows Guest Additions are designed to be installed in a virtual machine running a Windows operating system. The following versions of Windows guests are supported:

- Microsoft Windows 11
- Microsoft Windows Server 2022
- Microsoft Windows 10 (all builds)
- Microsoft Windows Server 2019

- Microsoft Windows Server 2016
- Microsoft Windows 8.1 (all editions)
- Microsoft Windows Server 2012R2
- Microsoft Windows 8 (all editions)
- Microsoft Windows Server 2012
- Microsoft Windows 7 (all editions)
- Microsoft Windows Server 2008R2
- Microsoft Windows Vista (all editions)
- Microsoft Windows Server 2008
- Microsoft Windows XP (any service pack)
- Microsoft Windows Server 2003 (any service pack)
- Microsoft Windows 2000 (any service pack)
- Microsoft Windows NT 4.0 (any service pack)

Installing the Windows Guest Additions

In the **Devices** menu in the virtual machine's menu bar, Oracle VM VirtualBox has a menu item **Insert Guest Additions CD Image**, which mounts the Guest Additions ISO file inside your virtual machine. A Windows guest should then automatically start the Guest Additions installer, which installs the Guest Additions on your Windows guest.

For other guest operating systems, or if automatic start of software on a CD is disabled, you need to do a manual start of the installer.

> **Note:**
>
> For the basic Direct3D acceleration to work in a Windows guest, you have to install the WDDM video driver available for Windows Vista or later.
>
> For Windows 8 and later, only the WDDM Direct3D video driver is available. For basic Direct3D acceleration to work in Windows XP guests, you have to install the Guest Additions in Safe Mode. See Known Limitations for details.

If you prefer to mount the Guest Additions manually, you can perform the following steps:

1. Start the virtual machine in which you have installed Windows.
2. Select **Optical Drives** from the **Devices** menu in the virtual machine's menu bar and then **Choose/Create a Disk Image**. This displays the Virtual Media Manager, described in The Virtual Media Manager.
3. In the Virtual Media Manager, click **Add** and browse your host file system for the `VBoxGuestAdditions.iso` file.
   - On a Windows host, this file is in the Oracle VM VirtualBox installation directory, usually in `C:\Program files\Oracle\VirtualBox`.
   - On macOS hosts, this file is in the application bundle of Oracle VM VirtualBox. Right-click on the Oracle VM VirtualBox icon in Finder and choose **Show Package Contents**. The file is located in the `Contents/MacOS` folder.

- On a Linux host, this file is in the `additions` folder where you installed Oracle VM VirtualBox, usually `/opt/VirtualBox/`.
- On Oracle Solaris hosts, this file is in the `additions` folder where you installed Oracle VM VirtualBox, usually `/opt/VirtualBox`.

4. In the Virtual Media Manager, select the ISO file and click the **Add** button. This mounts the ISO file and presents it to your Windows guest as a CD-ROM.

Unless you have the Autostart feature disabled in your Windows guest, Windows will now autostart the Oracle VM VirtualBox Guest Additions installation program from the Additions ISO. If the Autostart feature has been turned off, choose `VBoxWindowsAdditions.exe` from the CD/DVD drive inside the guest to start the installer.

The installer will add several device drivers to the Windows driver database and then invoke the hardware detection wizard.

Depending on your configuration, it might display warnings that the drivers are not digitally signed. You must confirm these in order to continue the installation and properly install the Additions.

After installation, reboot your guest operating system to activate the Additions.

Updating the Windows Guest Additions

Windows Guest Additions can be updated by running the installation program again. This replaces the previous Additions drivers with updated versions.

Alternatively, you can also open the Windows Device Manager and select **Update Driver...** for the following devices:

- Oracle VM VirtualBox Graphics Adapter
- Oracle VM VirtualBox System Device

For each, choose the option to provide your own driver, click **Have Disk** and navigate to the CD-ROM drive with the Guest Additions.

Unattended Installation of the Windows Guest Additions

You can configure unattended installation of the Oracle VM VirtualBox Guest Additions when you create a new VM using the **Create Virtual Machine** wizard. Select the **Guest Additions** check box on the **Unattended Guest OS Install** page of the wizard.

Guest Additions are installed automatically, following completion of the guest OS installation.

Installing Code Signing Certificates

To avoid popups when performing an unattended installation of the Oracle VM VirtualBox Guest Additions, the code signing certificates used to sign the drivers needs to be installed in the correct certificate stores on the guest operating system. Failure to do this will cause a typical Windows installation to display multiple dialogs asking whether you want to install a particular driver.

> **Note:**
>
> On some legacy Windows versions, such as Windows 2000 and Windows XP, the user intervention popups mentioned above are always displayed, even after importing the Oracle certificates.

Installing the code signing certificates on a Windows guest can be done automatically. Use the `VBoxCertUtil.exe` utility from the `cert` folder on the Guest Additions installation CD.

Use the following steps:

1. Log in as Administrator on the guest.
2. Mount the Oracle VM VirtualBox Guest Additions .ISO.
3. Open a command line window on the guest and change to the `cert` folder on the Oracle VM VirtualBox Guest Additions CD.
4. Run the following command:

   ```
   VBoxCertUtil.exe add-trusted-publisher vbox*.cer --root vbox*.cer
   ```

   This command installs the certificates to the certificate store. When installing the same certificate more than once, an appropriate error will be displayed.

To allow for completely unattended guest installations, you can specify a command line parameter to the install launcher:

```
VBoxWindowsAdditions.exe /S
```

This automatically installs the right files and drivers for the corresponding platform, either 32-bit or 64-bit.

> **Note:**
>
> By default on an unattended installation on a Vista or Windows 7 guest, there will be the XPDM graphics driver installed. This graphics driver does not support Windows Aero / Direct3D on the guest. Instead, the WDDM graphics driver needs to be installed. To select this driver by default, add the command line parameter `/with_wddm` when invoking the Windows Guest Additions installer. This is only required for Vista and Windows 7.

> **Note:**
>
> For Windows Aero to run correctly on a guest, the guest's VRAM size needs to be configured to at least 128 MB.

For more options regarding unattended guest installations, consult the command line help by using the command:

```
VBoxWindowsAdditions.exe /?
```

Manual File Extraction

If you would like to install the files and drivers manually, you can extract the files from the Windows Guest Additions setup as follows:

```
VBoxWindowsAdditions.exe /extract
```

To explicitly extract the Windows Guest Additions for another platform than the current running one, such as 64-bit files on a 32-bit system, you must use the appropriate platform installer. Use `VBoxWindowsAdditions-x86.exe` or `VBoxWindowsAdditions-amd64.exe` with the `/extract` parameter.

Guest Additions for Linux

Like the Windows Guest Additions, the Oracle VM VirtualBox Guest Additions for Linux are a set of device drivers and system applications which may be installed in the guest operating system.

The following Linux distributions are officially supported:

- Oracle Linux as of version 5, including UEK kernels
- Fedora as of Fedora Core 4
- Red Hat Enterprise Linux as of version 3
- SUSE and openSUSE Linux as of version 9
- Ubuntu as of version 5.10

Many other distributions are known to work with the Guest Additions.

The version of the Linux kernel supplied by default in SUSE and openSUSE 10.2, Ubuntu 6.10 (all versions) and Ubuntu 6.06 (server edition) contains a bug which can cause it to crash during startup when it is run in a virtual machine. The Guest Additions work in those distributions.

Note that some Linux distributions already come with all or part of the Oracle VM VirtualBox Guest Additions. You may choose to keep the distribution's version of the Guest Additions but these are often not up to date and limited in functionality, so we recommend replacing them with the Guest Additions that come with Oracle VM VirtualBox. The Oracle VM VirtualBox Linux Guest Additions installer tries to detect an existing installation and replace them but depending on how the distribution integrates the Guest Additions, this may require some manual interaction. It is highly recommended to take a snapshot of the virtual machine before replacing preinstalled Guest Additions.

Installing the Linux Guest Additions

The Oracle VM VirtualBox Guest Additions for Linux are provided on the same virtual CD-ROM file as the Guest Additions for Windows. See Installing the Windows Guest Additions. They also come with an installation program that guides you through the setup process. However, due to the significant differences between Linux distributions, installation may be slightly more complex when compared to Windows.

Installation generally involves the following steps:

1. Before installing the Guest Additions, you prepare your guest system for building external kernel modules. This works as described in The Oracle VM VirtualBox Kernel Modules,

except that this step must be performed in your Linux *guest* instead of on a Linux host system.

If you suspect that something has gone wrong, check that your guest is set up correctly and run the following command as root:

```
rcvboxadd setup
```

2. Insert the `VBoxGuestAdditions.iso` CD file into your Linux guest's virtual CD-ROM drive, as described for a Windows guest in Installing the Windows Guest Additions.
3. Change to the directory where your CD-ROM drive is mounted and run the following command as root:

```
sh ./VBoxLinuxAdditions.run
```

Unattended Installation of the Linux Guest Additions

You can configure unattended installation of the Oracle VM VirtualBox Guest Additions when you create a new VM using the **Create Virtual Machine** wizard. Select the **Guest Additions** check box on the **Unattended Guest OS Install** page of the wizard.

Guest Additions are installed automatically, following completion of the guest OS installation.

Graphics and Mouse Integration

In Linux and Oracle Solaris guests, Oracle VM VirtualBox graphics and mouse integration goes through the X Window System. Oracle VM VirtualBox can use the X.Org variant of the system, or XFree86 version 4.3 which is identical to the first X.Org release. During the installation process, the X.Org display server will be set up to use the graphics and mouse drivers which come with the Guest Additions.

After installing the Guest Additions into a fresh installation of a supported Linux distribution or Oracle Solaris system, many unsupported systems will work correctly too, the guest's graphics mode will change to fit the size of the Oracle VM VirtualBox window on the host when it is resized. You can also ask the guest system to switch to a particular resolution by sending a video mode hint using the `VBoxManage` tool.

Multiple guest monitors are supported in guests using the X.Org server version 1.3, which is part of release 7.3 of the X Window System version 11, or a later version. The layout of the guest screens can be adjusted as needed using the tools which come with the guest operating system.

If you want to understand more about the details of how the X.Org drivers are set up, in particular if you wish to use them in a setting which our installer does not handle correctly, see Guest Graphics and Mouse Driver Setup in Depth.

Starting from Oracle VM VirtualBox 7, Linux guest screen resize functionality for guests running VMSVGA graphics configuration has been changed. Since then, this functionality consists of a standalone daemon called VBoxDRMClient and its Desktop Environment helper counterpart.

VBoxDRMClient runs as a root process and is a bridge between the host and the guest's vmwgfx driver. This means that VBoxDRMClient listens to screen resize hints from the host and forwards them to the vmwgfx driver. This enables guest screen resize functionality to be available before the user has performed a graphical login.

In order to perform Desktop Environment specific actions, such as setting the primary screen in a multimonitor setup, a Desktop Environment helper is used. Once the user has performed a graphical login operation, the helper daemon starts with user session scope and attempts to

connect to VBoxDRMClient using an IPC connection. When VBoxDRMClient has received a corresponding command from the host, it is forwarded to the helper daemon over IPC and the action is then performed.

By default, VBoxDRMClient allows any process to connect to its IPC socket. This can be restricted by using the following steps:

1. The Guest Additions Linux installer creates a `vboxdrmipc` user group. A corresponding user needs to be added to this group.
2. You must set the `DRMIpcRestricted` guest property, as follows:

   ```
   VBoxManage guestproperty set "VM name" /VirtualBox/GuestAdd/DRMIpcRestricted 1 \
   --flags RDONLYGUEST
   ```

   It is important to set only the RDONLYGUEST flag for the property, so that it cannot be changed from inside the guest.

> **Note:**
>
> Both steps are required. If one of them is missing, all processes will have access to the IPC socket.

Restricted mode can be disabled by unsetting the guest property, as follows:

```
VBoxManage guestproperty unset "VM name" /VirtualBox/GuestAdd/DRMIpcRestricted
```

Updating the Linux Guest Additions

The Guest Additions can simply be updated by going through the installation procedure again with an updated CD-ROM image. This will replace the drivers with updated versions. You should reboot after updating the Guest Additions.

Uninstalling the Linux Guest Additions

If you have a version of the Guest Additions installed on your virtual machine and wish to remove it without installing new ones, you can do so by inserting the Guest Additions CD image into the virtual CD-ROM drive as described above. Then run the installer for the current Guest Additions with the `uninstall` parameter from the path that the CD image is mounted on in the guest, as follows:

```
sh ./VBoxLinuxAdditions.run uninstall
```

While this will normally work without issues, you may need to do some manual cleanup of the guest in some cases, especially of the XFree86Config or xorg.conf file. In particular, if the Additions version installed or the guest operating system were very old, or if you made your own changes to the Guest Additions setup after you installed them.

You can uninstall the Additions as follows:

```
/opt/VBoxGuestAdditions-version/uninstall.sh
```

Replace `/opt/VBoxGuestAdditions-version` with the correct Guest Additions installation directory.

Guest Additions for Oracle Solaris

Like the Windows Guest Additions, the Oracle VM VirtualBox Guest Additions for Oracle Solaris take the form of a set of device drivers and system applications which may be installed in the guest operating system.

The following Oracle Solaris distributions are officially supported:

- Oracle Solaris 11, including Oracle Solaris 11 Express
- Oracle Solaris 10 4/08 and later

Other distributions may work if they are based on comparable software releases.

Installing the Oracle Solaris Guest Additions

The Oracle VM VirtualBox Guest Additions for Oracle Solaris are provided on the same ISO CD-ROM as the Additions for Windows and Linux. They come with an installation program that guides you through the setup process.

Installation involves the following steps:

1. Mount the `VBoxGuestAdditions.iso` file as your Oracle Solaris guest's virtual CD-ROM drive, exactly the same way as described for a Windows guest in Installing the Windows Guest Additions.

   If the CD-ROM drive on the guest does not get mounted, as seen with some versions of Oracle Solaris 10, run the following command as root:

   ```
   svcadm restart volfs
   ```

2. Change to the directory where your CD-ROM drive is mounted and run the following command as root:

   ```
   pkgadd -G -d ./VBoxSolarisAdditions.pkg
   ```

3. Choose **1** and confirm installation of the Guest Additions package. After the installation is complete, log out and log in to X server on your guest, to activate the X11 Guest Additions.

Unattended Installation of the Oracle Solaris Guest Additions

You can configure unattended installation of the Oracle VM VirtualBox Guest Additions when you create a new VM using the **Create Virtual Machine** wizard. Select the **Guest Additions** check box on the **Unattended Guest OS Install** page of the wizard.

Guest Additions are installed automatically, following completion of the guest OS installation.

Uninstalling the Oracle Solaris Guest Additions

The Oracle Solaris Guest Additions can be safely removed by removing the package from the guest. Open a root terminal session and run the following command:

```
pkgrm SUNWvboxguest
```

Updating the Oracle Solaris Guest Additions

The Guest Additions should be updated by first uninstalling the existing Guest Additions and then installing the new ones. Attempting to install new Guest Additions without removing the existing ones is not possible.

Guest Additions for OS/2

Oracle VM VirtualBox also ships with a set of drivers that improve running OS/2 in a virtual machine. Due to restrictions of OS/2 itself, this variant of the Guest Additions has a limited feature set. See Known Limitations for details.

The OS/2 Guest Additions are provided on the same ISO CD-ROM as those for the other platforms. Mount the ISO in OS/2 as described previously. The OS/2 Guest Additions are located in the directory `\OS2`.

We do not provide an automatic installer at this time. See the `readme.txt` file in the CD-ROM directory, which describes how to install the OS/2 Guest Additions manually.

Shared Folders

With the *shared folders* feature of Oracle VM VirtualBox, you can access files of your host system from within the guest system. This is similar to how you would use network shares in Windows networks, except that shared folders do not require networking, only the Guest Additions. Shared folders are supported with Windows 2000 or later, Linux, and Oracle Solaris guests. Oracle VM VirtualBox includes experimental support for Mac OS X and OS/2 guests.

Shared folders physically reside on the *host* and are then shared with the guest, which uses a special file system driver in the Guest Additions to talk to the host. For Windows guests, shared folders are implemented as a pseudo-network redirector. For Linux and Oracle Solaris guests, the Guest Additions provide a virtual file system.

To share a host folder with a virtual machine in Oracle VM VirtualBox, you must specify the path of the folder and choose a *share name* that the guest can use to access the shared folder. This happens on the host. In the guest you can then use the share name to connect to it and access files.

There are several ways in which shared folders can be set up for a virtual machine:

- In the window of a running VM, you select **Shared Folders** from the **Devices** menu, or click on the folder icon on the status bar in the bottom right corner.
- If a VM is not currently running, you can configure shared folders in the virtual machine's **Settings** window.
- From the command line, you can create shared folders using `VBoxManage`, as follows:

  ```
  VBoxManage sharedfolder add "VM name" --name "sharename" --hostpath "C:\test"
  ```

  See VBoxManage sharedfolder.

There are two types of shares:

- Permanent shares, that are saved with the VM settings.
- Transient shares, that are added at runtime and disappear when the VM is powered off. These can be created using a check box in VirtualBox Manager, or by using the `--transient` option of the `VBoxManage sharedfolder add` command.

Shared folders can either be read-write or read-only. This means that the guest is either allowed to both read and write, or just read files on the host. By default, shared folders are read-write. Read-only folders can be created using a check box in the VirtualBox Manager, or with the `--readonly option` of the `VBoxManage sharedfolder add` command.

Oracle VM VirtualBox shared folders also support symbolic links, also called *symlinks*, under the following conditions:

- The host operating system must support symlinks. For example, a macOS, Linux, or Oracle Solaris host is required.
- The guest VM must have a version of the Guest Additions installed which supports symlinks. Currently only the Linux and Oracle Solaris Guest Additions support symlinks.
- For security reasons the guest OS is not allowed to create symlinks by default. If you trust the guest OS to not abuse the functionality, you can enable the creation of symlinks for a shared folder as follows:

  ```
  VBoxManage setextradata VM-name VBoxInternal2/SharedFoldersEnableSymlinksCreate/
  sharename 1
  ```

If a symbolic link is created inside a shared folder on the host and the installed Guest Additions do not support symbolic links then the guest will see the target of the symlink as a file inside the shared folder. For example, if a symlink is created to a file on a Linux host:

```
$ cd /SharedFolder && ln -s filename symlink-to-filename
```

When the shared folder is viewed on a Windows guest there will be two identical files listed, `filename` and `symlink-to-filename`.

Manual Mounting

You can mount the shared folder from inside a VM, in the same way as you would mount an ordinary network share:

- In a Windows guest, shared folders are browseable and therefore visible in Windows Explorer. To attach the host's shared folder to your Windows guest, open Windows Explorer and look for the folder in **My Networking Places**, **Entire Network**, **Oracle VM VirtualBox Shared Folders**. By right-clicking on a shared folder and selecting **Map Network Drive** from the menu that pops up, you can assign a drive letter to that shared folder.

  Alternatively, on the Windows command line, use the following command:

  ```
  net use x: \\vboxsvr\sharename
  ```

  While `vboxsvr` is a fixed name, note that `vboxsrv` would also work, replace *x:* with the drive letter that you want to use for the share, and *sharename* with the share name specified with `VBoxManage`.

- In a Linux guest, use the following command:

  ```
  mount -t vboxsf [-o OPTIONS] sharename mountpoint
  ```

  To mount a shared folder during boot, add the following entry to `/etc/fstab`:

  ```
  sharename   mountpoint   vboxsf   defaults  0   0
  ```

- In a Oracle Solaris guest, use the following command:

  ```
  mount -F vboxfs [-o OPTIONS] sharename mountpoint
  ```

  Replace *sharename*, use a lowercase string, with the share name specified with `VBoxManage` or VirtualBox Manager. Replace *mountpoint* with the path where you want the share to be mounted on the guest, such as `/mnt/share`. The usual mount rules apply. For example, create this directory first if it does not exist yet.

  Here is an example of mounting the shared folder for the user jack on Oracle Solaris:

```
$ id
uid=5000(jack) gid=1(other)
$ mkdir /export/home/jack/mount
$ pfexec mount -F vboxfs -o uid=5000,gid=1 jackshare /export/home/jack/mount
$ cd ~/mount
$ ls
sharedfile1.mp3 sharedfile2.txt
$
```

Beyond the standard options supplied by the `mount` command, the following are available:

`iocharset CHARSET`

This option sets the character set used for I/O operations. Note that on Linux guests, if the `iocharset` option is not specified, then the Guest Additions driver will attempt to use the character set specified by the CONFIG_NLS_DEFAULT kernel option. If this option is not set either, then UTF-8 is used.

`convertcp CHARSET`

This option specifies the character set used for the shared folder name. This is UTF-8 by default.

The generic mount options, documented in the `mount` manual page, apply also. Especially useful are the options `uid`, `gid` and `mode`, as they can allow access by normal users in read/write mode, depending on the settings, even if root has mounted the filesystem.

- In an OS/2 guest, use the `VBoxControl` command to manage shared folders. For example:

```
VBoxControl sharedfolder use D: MyShareName
VBoxControl sharedfolder unuse D:
VBoxControl sharedfolder list
```

As with Windows guests, shared folders can also be accessed via UNC using `\\VBoxSF\`, `\\VBoxSvr\` or `\\VBoxSrv\` as the server name and the shared folder name as *sharename*.

Automatic Mounting

Oracle VM VirtualBox provides the option to mount shared folders automatically. When automatic mounting is enabled for a shared folder, the Guest Additions service will mount it for you automatically. For Windows or OS/2, a preferred drive letter can also be specified. For Linux or Oracle Solaris, a mount point directory can also be specified.

If a drive letter or mount point is not specified, or is in use already, an alternative location is found by the Guest Additions service. The service searches for an alternative location depending on the guest OS, as follows:

- **Windows and OS/2 guests.** Search for a free drive letter, starting at `Z:`. If all drive letters are assigned, the folder is not mounted.
- **Linux and Oracle Solaris guests.** Folders are mounted under the `/media` directory. The folder name is normalized (no spaces, slashes or colons) and is prefixed with `sf_`.

  For example, if you have a shared folder called `myfiles`, it will appear as `/media/sf_myfiles` in the guest.

  The guest properties `/VirtualBox/GuestAdd/SharedFolders/MountDir` and the more generic `/VirtualBox/GuestAdd/SharedFolders/MountPrefix` can be used to override the automatic mount directory and prefix. See Guest Properties.

Access to an automatically mounted shared folder is granted to everyone in a Windows guest, including the guest user. For Linux and Oracle Solaris guests, access is restricted to members of the group `vboxsf` and the `root` user.

Drag and Drop

Oracle VM VirtualBox enables you to drag and drop content from the host to the guest, and vice versa. For this to work the latest version of the Guest Additions must be installed on the guest.

Drag and drop transparently allows copying or opening files, directories, and even certain clipboard formats from one end to the other. For example, from the host to the guest or from the guest to the host. You then can perform drag and drop operations between the host and a VM, as it would be a native drag and drop operation on the host OS.

At the moment drag and drop is implemented for Windows-based and X-Windows-based systems, both on the host and guest side. As X-Windows supports many different drag and drop protocols only the most common one, XDND, is supported for now. Applications using other protocols, such as Motif or OffiX, will not be recognized by Oracle VM VirtualBox.

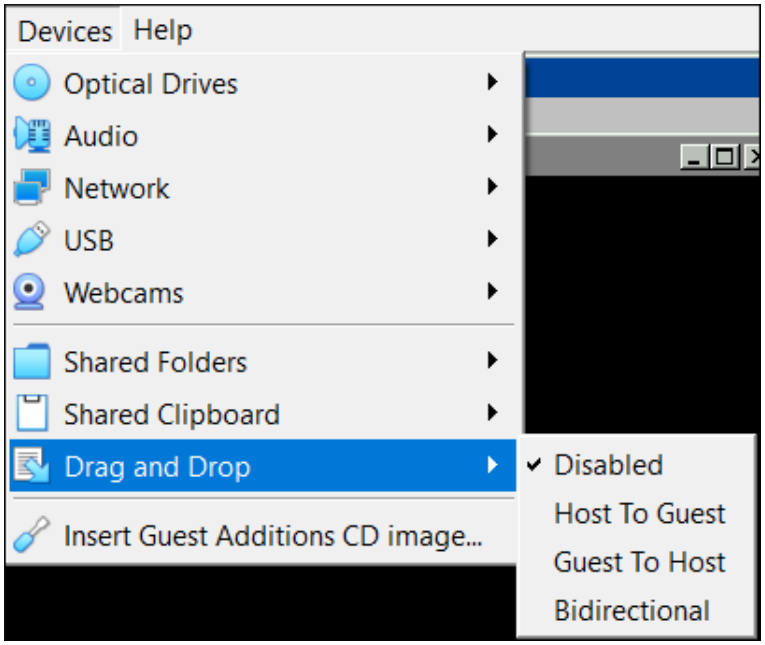
In the context of using drag and drop, the origin of the data is called the *source*. That is, where the actual data comes from and is specified. The *destination* specifies where the data from the source should go to. Transferring data from the source to the destination can be done in various ways, such as copying, moving, or linking.

> **Note:**
>
> At the moment only copying of data is supported. Moving or linking is not yet implemented.

When transferring data from the host to the guest OS, the host in this case is the source, whereas the guest OS is the destination. However, when transferring data from the guest OS to the host, the guest OS this time became the source and the host is the destination.

For security reasons drag and drop can be configured at runtime on a per-VM basis either using the **Drag and Drop** menu item in the **Devices** menu of the virtual machine, as shown below, or the `VBoxManage` command.

Figure 4-1 Drag and Drop Menu Options



The following drag and drop modes are available:

- **Disabled.** Disables the drag and drop feature entirely. This is the default when creating a new VM.
- **Host To Guest.** Enables drag and drop operations from the host to the guest only.
- **Guest To Host.** Enables drag and drop operations from the guest to the host only.
- **Bidirectional.** Enables drag and drop operations in both directions: from the host to the guest, and from the guest to the host.

> **Note:**
>
> Drag and drop support depends on the frontend being used. At the moment, only the VirtualBox Manager frontend provides this functionality.

To use the `VBoxManage` command to control the current drag and drop mode, see VBoxManage. The `modifyvm` and `controlvm` commands enable setting of a VM's current drag and drop mode from the command line.

Supported Formats

As Oracle VM VirtualBox can run on a variety of host operating systems and also supports a wide range of guests, certain data formats must be translated after transfer. This is so that the destination operating system, which receives the data, is able to handle them in an appropriate manner.

> **Note:**
>
> When dragging files no data conversion is done in any way. For example, when transferring a file from a Linux guest to a Windows host the Linux-specific line endings are not converted to Windows line endings.

The following formats are handled by the Oracle VM VirtualBox drag and drop service:

- **Plain text:** From applications such as text editors, internet browsers and terminal windows.
- **Files:** From file managers such as Windows Explorer, Nautilus, and Finder.
- **Directories:** For directories, the same formats apply as for files.

Known Limitations

The following limitations are known for drag and drop:

On Windows hosts, dragging and dropping content between UAC-elevated (User Account Control) programs and non-UAC-elevated programs is not allowed. If you start Oracle VM VirtualBox with Administrator privileges then drag and drop will not work with Windows Explorer, which runs with regular user privileges by default.

On Linux hosts and guests, programs can query for drag and drop data while the drag operation is still in progress. For example, on LXDE using the PCManFM file manager. This currently is not supported. As a workaround, a different file manager, such as Nautilus, can be used instead.

Hardware-Accelerated Graphics

Hardware 3D Acceleration (OpenGL and Direct3D 8/9)

The Oracle VM VirtualBox Guest Additions contain experimental hardware 3D support for Windows, Linux, and Oracle Solaris guests.

With this feature, if an application inside your virtual machine uses 3D features through the OpenGL or Direct3D 8/9 programming interfaces, instead of emulating them in software, which would be slow, Oracle VM VirtualBox will attempt to use your host's 3D hardware. This works for all supported host platforms, provided that your host operating system can make use of your accelerated 3D hardware in the first place.

The 3D acceleration feature currently has the following preconditions:

- It is only available for certain Windows, Linux, and Oracle Solaris guests. In particular:
  - 3D acceleration with Windows guests requires Windows 2000 or later. Apart from on Windows 2000 guests, both OpenGL and Direct3D 8/9 are supported on an experimental basis.
  - OpenGL on Linux requires kernel 2.6.27 or later, as well as X.org server version 1.5 or later. Ubuntu 10.10 and Fedora 14 have been tested and confirmed as working.
  - OpenGL on Oracle Solaris guests requires X.org server version 1.5 or later.
- The Guest Additions must be installed.

> **Note:**
>
> For the basic Direct3D acceleration to work in a Windows Guest, Oracle VM VirtualBox needs to replace Windows system files in the virtual machine. As a result, the Guest Additions installation program offers Direct3D acceleration as an option that must be explicitly enabled. Also, you must install the Guest Additions in Safe Mode. This does *not* apply to the WDDM Direct3D video driver available for Windows Vista and later. See Known Limitations for details.

- Because 3D support is still experimental at this time, it is disabled by default and must be *manually enabled* in the VM settings. See Display Settings.

> **Note:**
>
> Untrusted guest systems should not be allowed to use the 3D acceleration features of Oracle VM VirtualBox, just as untrusted host software should not be allowed to use 3D acceleration. Drivers for 3D hardware are generally too complex to be made properly secure and any software which is allowed to access them may be able to compromise the operating system running them. In addition, enabling 3D acceleration gives the guest direct access to a large body of additional program code in the Oracle VM VirtualBox host process which it might conceivably be able to use to crash the virtual machine.

To enable Aero theme support, the Oracle VM VirtualBox WDDM video driver must be installed, which is available with the Guest Additions installation. The WDDM driver is not installed by default for Vista and Windows 7 guests and must be *manually selected* in the Guest Additions installer by clicking **No** in the **Would You Like to Install Basic Direct3D Support** dialog displayed when the Direct3D feature is selected.

The Aero theme is not enabled by default on Windows. See your Windows platform documentation for details of how to enable the Aero theme.

Technically, Oracle VM VirtualBox implements 3D acceleration by installing an additional hardware 3D driver inside the guest when the Guest Additions are installed. This driver acts as a hardware 3D driver and reports to the guest operating system that the virtual hardware is capable of 3D hardware acceleration. When an application in the guest then requests hardware acceleration through the OpenGL or Direct3D programming interfaces, these are sent to the host through a special communication tunnel implemented by Oracle VM VirtualBox. The *host* then performs the requested 3D operation using the host's programming interfaces.

Hardware 2D Video Acceleration for Windows Guests

The Oracle VM VirtualBox Guest Additions contain experimental hardware 2D video acceleration support for Windows guests.

With this feature, if an application such as a video player inside your Windows VM uses 2D video overlays to play a movie clip, then Oracle VM VirtualBox will attempt to use your host's video acceleration hardware instead of performing overlay stretching and color conversion in software, which would be slow. This currently works for Windows, Linux and macOS host platforms, provided that your host operating system can make use of 2D video acceleration in the first place.

Hardware 2D video acceleration currently has the following preconditions:

- Only available for Windows guests, running Windows XP or later.
- Guest Additions must be installed.
- Because 2D support is still experimental at this time, it is disabled by default and must be *manually enabled* in the VM settings. See Display Settings.

Technically, Oracle VM VirtualBox implements this by exposing video overlay DirectDraw capabilities in the Guest Additions video driver. The driver sends all overlay commands to the host through a special communication tunnel implemented by Oracle VM VirtualBox. On the host side, OpenGL is then used to implement color space transformation and scaling.

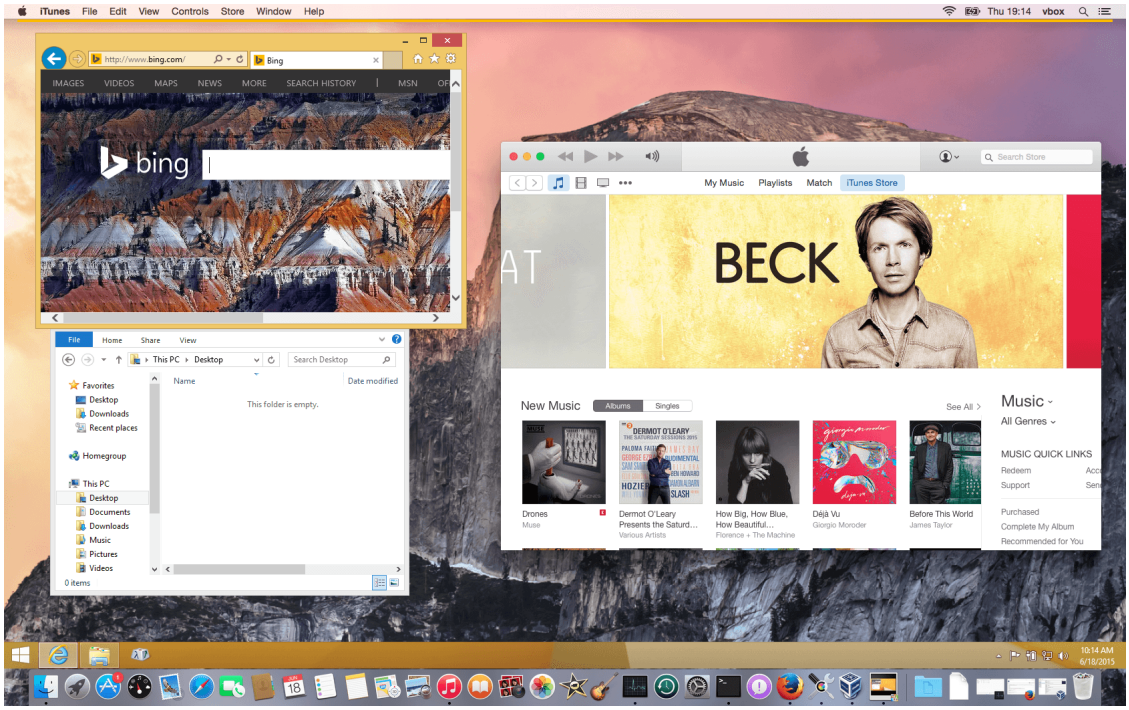
Seamless Windows

With the *seamless windows* feature of Oracle VM VirtualBox, you can have the windows that are displayed within a virtual machine appear side by side next to the windows of your host. This feature is supported for the following guest operating systems, provided that the Guest Additions are installed:

- Windows guests.
- Supported Linux or Oracle Solaris guests running the X Window System.

After seamless windows are enabled, Oracle VM VirtualBox suppresses the display of the desktop background of your guest, allowing you to run the windows of your guest operating system seamlessly next to the windows of your host.

Figure 4-2 Seamless Windows on a Host Desktop



To enable seamless mode, after starting the virtual machine, press the **Host key + L**. The Host key is normally the right control key. This will enlarge the size of the VM's display to the size of

your host screen and mask out the guest operating system's background. To disable seamless windows and go back to the normal VM display, press the Host key + L again.

Guest Properties

Oracle VM VirtualBox enables requests of some properties from a running guest, provided that the Oracle VM VirtualBox Guest Additions are installed and the VM is running. This provides the following advantages:

- A number of predefined VM characteristics are automatically maintained by Oracle VM VirtualBox and can be retrieved on the host. For example, to monitor VM performance and statistics.
- Arbitrary string data can be exchanged between guest and host. This works in both directions.

To accomplish this, Oracle VM VirtualBox establishes a private communication channel between the Oracle VM VirtualBox Guest Additions and the host, and software on both sides can use this channel to exchange string data for arbitrary purposes. Guest properties are simply string keys to which a value is attached. They can be set, or written to, by either the host and the guest. They can also be read from both sides.

In addition to establishing the general mechanism of reading and writing values, a set of predefined guest properties is automatically maintained by the Oracle VM VirtualBox Guest Additions to allow for retrieving interesting guest data such as the guest's exact operating system and service pack level, the installed version of the Guest Additions, users that are currently logged into the guest OS, network statistics and more. These predefined properties are all prefixed with `/VirtualBox/` and organized into a hierarchical tree of keys.

Some of this runtime information is shown when you select **Session Information Dialog** from a virtual machine's **Machine** menu.

A more flexible way to use this channel is with the `VBoxManage guestproperty` command. See VBoxManage guestproperty. For example, to have *all* the available guest properties for a given running VM listed with their respective values, use this command:

```
$ VBoxManage guestproperty enumerate "Windows Vista III"
VirtualBox Command Line Management Interface Version version-number
Copyright (C) 2005-2022 Oracle and/or its affiliates

Name: /VirtualBox/GuestInfo/OS/Product, value: Windows Vista Business Edition,
    timestamp: 1229098278843087000, flags:
Name: /VirtualBox/GuestInfo/OS/Release, value: 6.0.6001,
    timestamp: 1229098278950553000, flags:
Name: /VirtualBox/GuestInfo/OS/ServicePack, value: 1,
    timestamp: 1229098279122627000, flags:
Name: /VirtualBox/GuestAdd/InstallDir,
    value: C:/Program Files/Oracle/VirtualBox
    Guest Additions, timestamp: 1229098279269739000, flags:
Name: /VirtualBox/GuestAdd/Revision, value: 40720,
    timestamp: 1229098279345664000, flags:
Name: /VirtualBox/GuestAdd/Version, value: version-number,
    timestamp: 1229098279479515000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxControl.exe, value: version-numberr40720,
    timestamp: 1229098279651731000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxHook.dll, value: version-numberr40720,
    timestamp: 1229098279804835000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxDisp.dll, value: version-numberr40720,
    timestamp: 1229098279880611000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxMRXNP.dll, value: version-numberr40720,
```

```
    timestamp: 1229098279882618000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxService.exe, value: version-numberr40720,
    timestamp: 1229098279883195000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxTray.exe, value: version-numberr40720,
    timestamp: 1229098279885027000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxGuest.sys, value: version-numberr40720,
    timestamp: 1229098279886838000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxMouse.sys, value: version-numberr40720,
    timestamp: 1229098279890600000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxSF.sys, value: version-numberr40720,
    timestamp: 1229098279893056000, flags:
Name: /VirtualBox/GuestAdd/Components/VBoxVideo.sys, value: version-numberr40720,
    timestamp: 1229098279895767000, flags:
Name: /VirtualBox/GuestInfo/OS/LoggedInUsers, value: 1,
    timestamp: 1229099826317660000, flags:
Name: /VirtualBox/GuestInfo/OS/NoLoggedInUsers, value: false,
    timestamp: 1229098455580553000, flags:
Name: /VirtualBox/GuestInfo/Net/Count, value: 1,
    timestamp: 1229099826299785000, flags:
Name: /VirtualBox/HostInfo/GUI/LanguageID, value: C,
    timestamp: 1229098151272771000, flags:
Name: /VirtualBox/GuestInfo/Net/0/V4/IP, value: 192.168.2.102,
    timestamp: 1229099826300088000, flags:
Name: /VirtualBox/GuestInfo/Net/0/V4/Broadcast, value: 255.255.255.255,
    timestamp: 1229099826300220000, flags:
Name: /VirtualBox/GuestInfo/Net/0/V4/Netmask, value: 255.255.255.0,
    timestamp: 1229099826300350000, flags:
Name: /VirtualBox/GuestInfo/Net/0/Status, value: Up,
    timestamp: 1229099826300524000, flags:
Name: /VirtualBox/GuestInfo/OS/LoggedInUsersList, value: username,
    timestamp: 1229099826317386000, flags:
```

To query the value of a single property, use the `get` subcommand as follows:

```
$ VBoxManage guestproperty get "Windows Vista III" "/VirtualBox/GuestInfo/OS/Product"
VirtualBox Command Line Management Interface Version version-number
Copyright (C) 2005-2022 Oracle and/or its affiliates

Value: Windows Vista Business Edition
```

To add or change guest properties from the guest, use the tool `VBoxControl`. This tool is included in the Guest Additions. When started from a Linux guest, this tool requires root privileges for security reasons.

```
$ sudo VBoxControl guestproperty enumerate
VirtualBox Guest Additions Command Line Management Interface Version version-number
Copyright (C) 2005-2022 Oracle and/or its affiliates

Name: /VirtualBox/GuestInfo/OS/Release, value: 2.6.28-18-generic,
    timestamp: 1265813265835667000, flags: <NULL>
Name: /VirtualBox/GuestInfo/OS/Version, value: #59-Ubuntu SMP Thu Jan 28 01:23:03 UTC
2010,
    timestamp: 1265813265836305000, flags: <NULL>
      ...
```

For more complex needs, you can use the Oracle VM VirtualBox programming interfaces. See Oracle VM VirtualBox Programming Interfaces.

Using Guest Properties to Wait on VM Events

The properties `/VirtualBox/HostInfo/VBoxVer`, `/VirtualBox/HostInfo/VBoxVerExt` or `/VirtualBox/HostInfo/VBoxRev` can be waited on to detect that the VM state was restored from saved state or snapshot:

```
$ VBoxControl guestproperty wait /VirtualBox/HostInfo/VBoxVer
```

Similarly the `/VirtualBox/HostInfo/ResumeCounter` can be used to detect that a VM was resumed from the paused state or saved state.

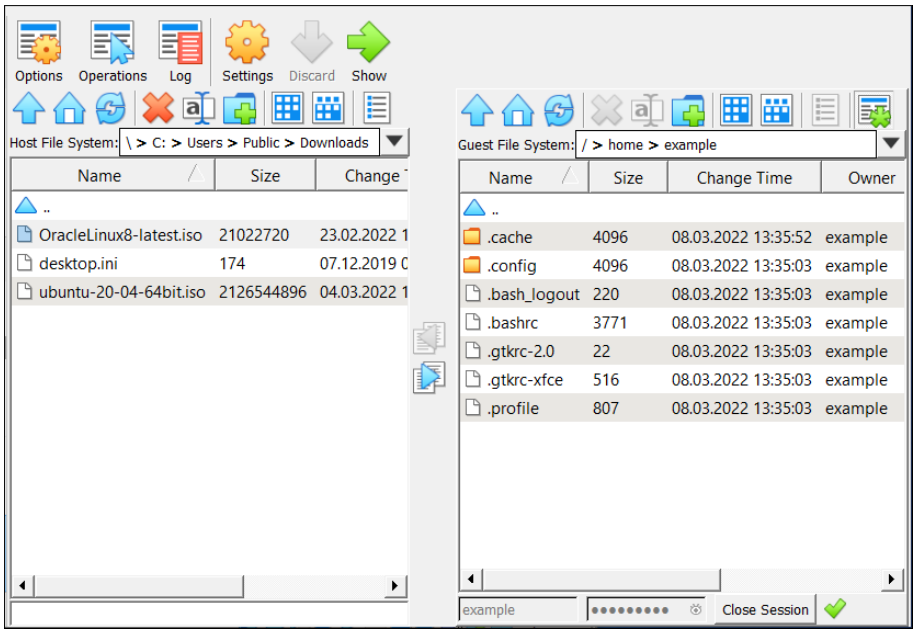
Guest Control File Manager

The Guest Control File Manager is a feature of the Guest Additions that enables easy copying and moving of files between a guest and the host system. Other file management operations provide support to create new folders and to rename or delete files.

This feature is useful when the VM window of a guest is not visible. For example, when the guest is running in headless mode.

> **Note:**
>
> To use the Guest Control File Manager, the guest must be running. For powered-off guests, it is disabled automatically.

Figure 4-3 Guest Control File Manager



The Guest Control File Manager works by mounting the host file system. Guest users must authenticate and create a guest session before they can transfer files.

Using the Guest Control File Manager

The following steps describe how to use the Guest Control File Manager.

1. Open the Guest Control File Manager. Do either of the following:
   - In the guest VM, select **Machine**, **File Manager**.
   - In VirtualBox Manager, click on the machine name. Click **File Manager** in the machine tools menu for the VM.

   The left pane shows the files on the host system.
2. Create a guest session.

   At the bottom of the Guest Control File Manager, enter authentication credentials for a user on the guest system.

   Click **Create Session**.

   The contents of the guest VM file system appears in the right pane of the Guest Control File Manager.
3. Transfer files between the guest and the host system by using the move and copy file transfer icons.

   You can copy and move files from the guest to the host system or from the host system to the guest.
4. Close the Guest Control File Manager.

   Click **Close** to end the guest session.

Guest Control of Applications

The Guest Additions enable starting of applications inside a guest VM from the host system. This feature can be used to automate deployment of software within the guest.

For this to work, the application needs to be installed on the guest. No additional software needs to be installed on the host. Additionally, text mode output to stdout and stderr can be shown on the host for further processing. There are options to specify user credentials and a timeout value, in milliseconds, to limit the time the application is able to run.

The Guest Additions for Windows allow for automatic updating. This applies for already installed Guest Additions versions. Also, copying files from host to the guest as well as remotely creating guest directories is available.

To use these features, use the Oracle VM VirtualBox command line. See VBoxManage guestcontrol.

Memory Overcommitment

In server environments with many VMs, the Guest Additions can be used to share physical host memory between several VMs. This reduces the total amount of memory in use by the VMs. If memory usage is the limiting factor and CPU resources are still available, this can help with running more VMs on each host.

Memory Ballooning

The Guest Additions can change the amount of host memory that a VM uses, while the machine is running. Because of how this is implemented, this feature is called *memory ballooning*.

> **Note:**
>
> - Oracle VM VirtualBox supports memory ballooning only on 64-bit hosts. It is not supported on macOS hosts.
> - Memory ballooning does not work well with large pages enabled. To turn off large pages support for a VM, run `VBoxManage modifyvm vmname --large-pages off`

Normally, to change the amount of memory allocated to a virtual machine, you have to shut down the virtual machine entirely and modify its settings. With memory ballooning, memory that was allocated for a virtual machine can be given to another virtual machine without having to shut the machine down.

When memory ballooning is requested, the Oracle VM VirtualBox Guest Additions, which run inside the guest, allocate physical memory from the guest operating system on the kernel level and lock this memory down in the guest. This ensures that the guest will not use that memory any longer. No guest applications can allocate it, and the guest kernel will not use it either. Oracle VM VirtualBox can then reuse this memory and give it to another virtual machine.

The memory made available through the ballooning mechanism is only available for reuse by Oracle VM VirtualBox. It is *not* returned as free memory to the host. Requesting balloon memory from a running guest will therefore not increase the amount of free, unallocated memory on the host. Effectively, memory ballooning is therefore a memory overcommitment mechanism for multiple virtual machines while they are running. This can be useful to temporarily start another machine, or in more complicated environments, for sophisticated memory management of many virtual machines that may be running in parallel depending on how memory is used by the guests.

At this time, memory ballooning is only supported through `VBoxManage`. Use the following command to increase or decrease the size of the memory balloon within a running virtual machine that has Guest Additions installed:

```
VBoxManage controlvm "VM name" guestmemoryballoon n
```

where *VM name* is the name or UUID of the virtual machine in question and *n* is the amount of memory to allocate from the guest in megabytes. See VBoxManage controlvm.

You can also set a default balloon that will automatically be requested from the VM every time after it has started up with the following command:

```
VBoxManage modifyvm "VM name" --guest-memory-balloon n
```

By default, no balloon memory is allocated. This is a VM setting, like other `modifyvm` settings, and therefore can only be set while the machine is shut down. See VBoxManage modifyvm.

Page Fusion

Whereas memory ballooning simply reduces the amount of RAM that is available to a VM, Page Fusion works differently. It avoids memory duplication between several similar running VMs.

In a server environment running several similar VMs on the same host, lots of memory pages are identical. For example, if the VMs are using identical operating systems. Oracle VM VirtualBox's Page Fusion technology can efficiently identify these identical memory pages and share them between multiple VMs.

> **Note:**
>
> Oracle VM VirtualBox supports Page Fusion only on 64-bit hosts, and it is not supported on macOS hosts. Page Fusion currently works only with Windows 2000 and later guests.

The more similar the VMs on a given host are, the more efficiently Page Fusion can reduce the amount of host memory that is in use. It therefore works best if all VMs on a host run identical operating systems. Instead of having a complete copy of each operating system in each VM, Page Fusion identifies the identical memory pages in use by these operating systems and eliminates the duplicates, sharing host memory between several machines. This is called *deduplication*. If a VM tries to modify a page that has been shared with other VMs, a new page is allocated again for that VM with a copy of the shared page. This is called *copy on write*. All this is fully transparent to the virtual machine.

You may be familiar with this kind of memory overcommitment from other hypervisor products, which call this feature *page sharing* or *same page merging*. However, Page Fusion differs significantly from those other solutions, whose approaches have several drawbacks:

- Traditional hypervisors scan *all* guest memory and compute checksums, also called hashes, for every single memory page. Then, they look for pages with identical hashes and compare the entire content of those pages. If two pages produce the same hash, it is very likely that the pages are identical in content. This process can take rather long, especially if the system is not idling. As a result, the additional memory only becomes available after a significant amount of time, such as hours or sometimes days. Even worse, this kind of page sharing algorithm generally consumes significant CPU resources and increases the virtualization overhead by 10 to 20%.

  Page Fusion in Oracle VM VirtualBox uses logic in the Oracle VM VirtualBox Guest Additions to quickly identify memory cells that are most likely identical across VMs. It can therefore achieve most of the possible savings of page sharing almost immediately and with almost no overhead.

- Page Fusion is also much less likely to be confused by identical memory that it will eliminate, just to learn seconds later that the memory will now change and having to perform a highly expensive and often service-disrupting reallocation.

At this time, Page Fusion can only be controlled with `VBoxManage`, and only while a VM is shut down. To enable Page Fusion for a VM, use the following command:

```
VBoxManage modifyvm "VM name" --page-fusion on
```

You can observe Page Fusion operation using some metrics. `RAM/VMM/Shared` shows the total amount of fused pages, whereas the per-VM metric `Guest/RAM/Usage/Shared` will return the

amount of fused memory for a given VM. See VBoxManage metrics for information on how to query metrics.

> **Note:**
>
> Enabling Page Fusion might indirectly increase the chances for malicious guests to successfully attack other VMs running on the same host. See Potentially Insecure Operations.

Controlling Virtual Monitor Topology

X11/Wayland Desktop Environments

The Guest Additions provide services for controlling the guest system's monitor topology. Monitor topology means the resolution of each virtual monitor and its state (disabled/enabled). The resolution of a virtual monitor can be modified from the host side either by resizing the window that hosts the virtual monitor, by using the **View** menu or the `VBoxManage controlvm vmname setscreenlayout` command. On guest operating systems with X11/Wayland desktops this is put into effect by either of the following two services:

```
VBoxClient --vmsvga
VBoxDRMClient
```

The following are some details about guest screen resolution control functionality:

- On X11/Wayland desktops the resizing service is started during desktop session initialization, that is desktop login. On X11 desktops `VBoxClient --vmsvga` handles screen topology through the RandR extension. On Wayland clients `VBoxDRMClient` is used. The decision is made automatically at each desktop session start.
- On 32-bit guest operating systems `VBoxDRMClient` is always used, in order to work around bugs.
- Since the monitor topology control services are initialized during the desktop session start, it is impossible to control the monitor resolution of display managers such as GDM or LightDM. This default behavior can be changed by setting the guest property `/VirtualBox/GuestAdd/DRMResize` of the virtual machine to any value. See Guest Properties for details of how to update guest properties. When this guest property is set then `VBoxDRMClient` is started during the guest OS boot and stays active all the time, for both the display manager login screen and the desktop session.

Known Limitations

`VBoxDRMClient` is not able to handle arbitrary guest monitor topologies. Specifically, disabling a guest monitor that is not the last one invalidates the monitor topology due to limitations in the `vmwgfx.ko` Linux kernel module. For example, when the guest is configured to have four monitors it is not recommended to disable the second or third monitor.

5
Virtual Storage

As the virtual machine will most probably expect to see a hard disk built into its virtual computer, Oracle VM VirtualBox must be able to present real storage to the guest as a virtual hard disk. There are presently three methods by which to achieve this:

- Oracle VM VirtualBox can use large image files on a real hard disk and present them to a guest as a virtual hard disk. This is the most common method, described in Disk Image Files (VDI, VMDK, VHD, HDD).
- iSCSI storage servers can be attached to Oracle VM VirtualBox. This is described in iSCSI Servers.
- You can allow a virtual machine to access one of your host disks directly. This is an advanced feature, described in Using a Raw Host Hard Disk From a Guest.

Each such virtual storage device, such as an image file, iSCSI target, or physical hard disk, needs to be connected to the virtual hard disk controller that Oracle VM VirtualBox presents to a virtual machine. This is explained in the next section.

Hard Disk Controllers

In a computing device, hard disks and CD/DVD drives are connected to a device called a hard disk controller, which drives hard disk operation and data transfers. Oracle VM VirtualBox can emulate the most common types of hard disk controllers typically found in computing devices: IDE, SATA (AHCI), SCSI, SAS, USB-based, NVMe and virtio-scsi mass storage devices.

- **IDE (ATA)** controllers are a backwards-compatible yet very advanced extension of the disk controller in the IBM PC/AT (1984). Initially, this interface worked only with hard disks, but was later extended to also support CD-ROM drives and other types of removable media. In physical PCs, this standard uses flat ribbon parallel cables with 40 or 80 wires. Each such cable can connect two devices, called device 0 and device 1, to a controller. Typical PCs had two connectors for such cables. As a result, support for up to four IDE devices was most common: primary device 0, primary device 1, secondary device 0, and secondary device 1.

  In Oracle VM VirtualBox, each virtual machine may have one IDE controller enabled, which gives you up to four virtual storage devices that you can attach to the machine. By default, one of these virtual storage devices, device 0 on the secondary channel, is preconfigured to be the virtual machine's virtual CD/DVD drive. However, you can change the default setting.

  Even if your guest OS has no support for SCSI or SATA devices, it should always be able to see an IDE controller.

  You can also select which exact type of IDE controller hardware Oracle VM VirtualBox should present to the virtual machine: PIIX3, PIIX4, or ICH6. This makes no difference in terms of performance, but if you import a virtual machine from another virtualization product, the OS in that machine may expect a particular controller type and crash if it is not found.

  After you have created a new virtual machine with the **New Virtual Machine** wizard in VirtualBox Manager, you will typically see one IDE controller in the machine's **Storage**

settings. The virtual CD/DVD drive will be attached to one of the four ports of this controller.

- **Serial ATA (SATA)** is a more recent standard than IDE. Compared to IDE, it supports both much higher speeds and more devices per controller. Also, with physical hardware, devices can be added and removed while the system is running. The standard interface for SATA controllers is called Advanced Host Controller Interface (AHCI).

  Like a real SATA controller, Oracle VM VirtualBox's virtual SATA controller operates faster and also consumes fewer CPU resources than the virtual IDE controller. Also, this enables you to connect up to 30 virtual hard disks to one machine instead of just three, when compared to the Oracle VM VirtualBox IDE controller with a DVD drive attached.

  For this reason, depending on the selected guest OS, Oracle VM VirtualBox uses SATA as the default for newly created virtual machines. One virtual SATA controller is created by default, and the default disk that is created with a new VM is attached to this controller.

  > **Note:**
  >
  > The entire SATA controller and the virtual disks attached to it, including those in IDE compatibility mode, will not be seen by OSes that do not have device support for AHCI. In particular, *there is no support for AHCI in Windows versions before Windows Vista*. Legacy Windows versions such as Windows XP, even with SP3 installed, will not see such disks unless you install additional drivers. It is possible to switch from IDE to SATA after installation by installing the SATA drivers and changing the controller type in the VM **Settings** window.
  >
  > Oracle VM VirtualBox recommends the Intel Matrix Storage drivers, which can be downloaded from http://downloadcenter.intel.com/Product_Filter.aspx?ProductID=2101.

  To add a SATA controller to a machine for which it has not been enabled by default, either because it was created by an earlier version of Oracle VM VirtualBox, or because SATA is not supported by default by the selected guest OS, do the following. Go to the **Storage** page of the machine's **Settings** window, click **Add Controller** under the Storage Tree box and then select **Add SATA Controller**. The new controller appears as a separate PCI device in the virtual machine, and you can add virtual disks to it.

  To change the IDE compatibility mode settings for the SATA controller, see VBoxManage storagectl.

- **SCSI** is another established industry standard, standing for Small Computer System Interface. SCSI is as a generic interface for data transfer between all kinds of devices, including storage devices. SCSI is still used for connecting some hard disks and tape devices, but it has mostly been displaced in commodity hardware. It is still in common use in high-performance workstations and servers.

  Primarily for compatibility with other virtualization software, Oracle VM VirtualBox optionally supports LSI Logic and BusLogic SCSI controllers, to each of which up to fifteen virtual hard disks can be attached.

  To enable a SCSI controller, on the **Storage** page of a virtual machine's **Settings** window, click **Add Controller** under the Storage Tree box and then select **Add SCSI Controller**. The new controller appears as a separate PCI device in the virtual machine.

> **Note:**
>
> As with the other controller types, a SCSI controller will only be seen by OSes with device support for it. Windows 2003 and later ships with drivers for the LSI Logic controller, while Windows NT 4.0 and Windows 2000 ships with drivers for the BusLogic controller. Windows XP ships with drivers for neither.

- **Serial Attached SCSI (SAS)** is another bus standard which uses the SCSI command set. As opposed to SCSI physical devices, serial cables are used instead of parallel cables. This simplifies physical device connections. In some ways, therefore, SAS is to SCSI what SATA is to IDE: it enables more reliable and faster connections.

  To support high-end guests which require SAS controllers, Oracle VM VirtualBox emulates a LSI Logic SAS controller, which can be enabled much the same way as a SCSI controller. At this time, up to 255 devices can be connected to the SAS controller.

  > **Note:**
  >
  > As with SATA, the SAS controller will only be seen by OSes with device support for it. In particular, *there is no support for SAS in Windows before Windows Vista*. So Windows XP, even SP3, will not see such disks unless you install additional drivers.

- The **USB mass storage device class** is a standard to connect external storage devices like hard disks or flash drives to a host through USB. All major OSes support these devices and ship generic drivers making third-party drivers superfluous. In particular, legacy OSes without support for SATA controllers may benefit from USB mass storage devices.

  The virtual USB storage controller offered by Oracle VM VirtualBox works differently to the other storage controller types. While most storage controllers appear as a single PCI device to the guest with multiple disks attached to it, the USB-based storage controller does not appear as virtual storage controller. Each disk attached to the controller appears as a dedicated USB device to the guest.

  > **Note:**
  >
  > Booting from drives attached using USB is only supported when EFI is used as the BIOS lacks USB support.

- **Non volatile memory express (NVMe)** is a standard for connecting non volatile memory (NVM) directly over PCI Express to lift the bandwidth limitation of the previously used SATA protocol for solid-state devices. Unlike other standards the command set is very simple in order to achieve maximum throughput and is not compatible with ATA or SCSI. OSes need to support NVMe devices to make use of them. For example, Windows 8.1 added native NVMe support. For Windows 7, native support was added with an update.

  The NVMe controller is part of the extension pack.

> **Note:**
>
> Booting from drives attached using NVMe is only supported when EFI is used as the BIOS lacks the appropriate driver.

- **Virtual I/O Device SCSI** is a standard to connect virtual storage devices like hard disks or optical drives to a VM. Recent Linux and Windows versions support these devices, but Windows needs additional drivers. Currently virtio-scsi controller support is experimental.

> **Note:**
>
> The virtio-scsi controller will only be seen by OSes with device support for it. In particular, *there is no built-in support in Windows*. So Windows will not see such disks unless you install additional drivers.

In summary, Oracle VM VirtualBox gives you the following categories of virtual storage slots:

- Four slots attached to the traditional IDE controller, which are always present. One of these is typically a virtual CD/DVD drive.
- 30 slots attached to the SATA controller, if enabled and supported by the guest OS.
- 15 slots attached to the SCSI controller, if enabled and supported by the guest OS.
- Up to 255 slots attached to the SAS controller, if enabled and supported by the guest OS.
- Eight slots attached to the virtual USB controller, if enabled and supported by the guest OS.
- Up to 255 slots attached to the NVMe controller, if enabled and supported by the guest OS.
- Up to 256 slots attached to the virtio-scsi controller, if enabled and supported by the guest OS.

Given this large choice of storage controllers, you may not know which one to choose. In general, you should avoid IDE unless it is the only controller supported by your guest. Whether you use SATA, SCSI, or SAS does not make any real difference. The variety of controllers is only supplied by Oracle VM VirtualBox for compatibility with existing hardware and other hypervisors.

Disk Image Files (VDI, VMDK, VHD, HDD)

Disk image files reside on the host system and are seen by the guest systems as hard disks of a certain geometry. When a guest OS reads from or writes to a hard disk, Oracle VM VirtualBox redirects the request to the image file.

Like a physical disk, a virtual disk has a size, or capacity, which must be specified when the image file is created. As opposed to a physical disk however, Oracle VM VirtualBox enables you to expand an image file after creation, even if it has data already. See VBoxManage modifymedium.

Oracle VM VirtualBox supports the following types of disk image files:

- **VDI.** Normally, Oracle VM VirtualBox uses its own container format for guest hard disks. This is called a Virtual Disk Image (VDI) file. This format is used when you create a new virtual machine with a new disk.

- **VMDK.**Oracle VM VirtualBox also fully supports the popular and open VMDK container format that is used by many other virtualization products, such as VMware.
- **VHD.**Oracle VM VirtualBox also fully supports the VHD format used by Microsoft.
- **HDD.** Image files of Parallels version 2 (HDD format) are also supported.

  Due to lack of documentation of the format, newer versions such as 3 and 4 are not supported. You can however convert such image files to version 2 format using tools provided by Parallels.

Irrespective of the disk capacity and format, as mentioned in Creating Your First Virtual Machine, there are two options for creating a disk image: fixed-size or dynamically allocated.

- **Fixed-size.** If you create a fixed-size image, an image file will be created on your host system which has roughly the same size as the virtual disk's capacity. So, for a 10 GB disk, you will have a 10 GB file. Note that the creation of a fixed-size image can take a long time depending on the size of the image and the write performance of your hard disk.
- **Dynamically allocated.** For more flexible storage management, use a dynamically allocated image. This will initially be very small and not occupy any space for unused virtual disk sectors, but will grow every time a disk sector is written to for the first time, until the drive reaches the maximum capacity chosen when the drive was created. While this format takes less space initially, the fact that Oracle VM VirtualBox needs to expand the image file consumes additional computing resources, so until the disk file size has stabilized, write operations may be slower than with fixed size disks. However, after a time the rate of growth will slow and the average penalty for write operations will be negligible.

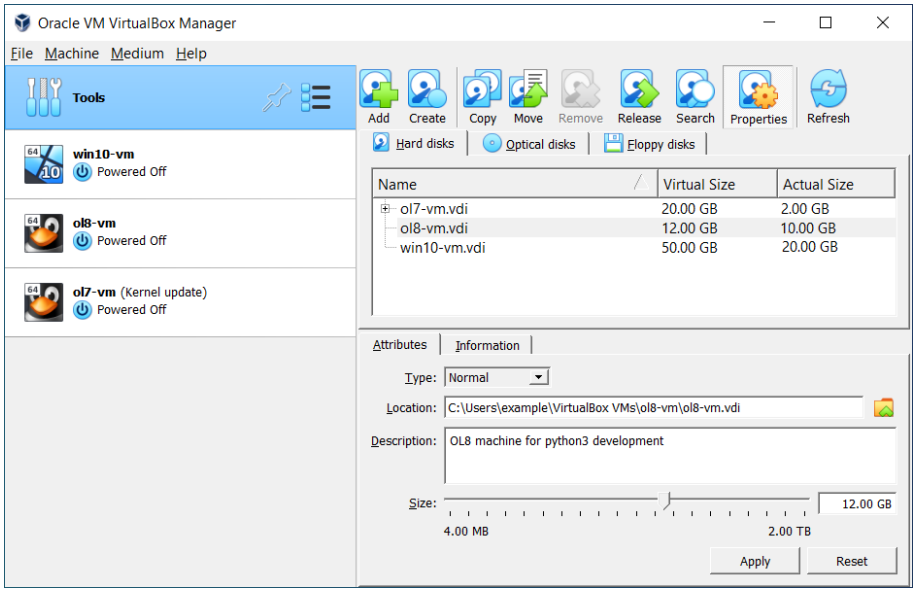
The Virtual Media Manager

Oracle VM VirtualBox keeps track of all the hard disk, CD/DVD-ROM, and floppy disk images which are in use by virtual machines. These are often referred to as *known media* and come from two sources:

- All media currently attached to virtual machines.
- Registered media, for compatibility with legacy Oracle VM VirtualBox versions.

The known media can be viewed and changed using the **Virtual Media Manager** tool, which you access by clicking **Media** on the global **Tools** menu in VirtualBox Manager.

Figure 5-1 The Virtual Media Manager, Showing Hard Disk Images



The known media are conveniently grouped in separate tabs for the supported formats. These formats are:

- Hard disk images, either in Oracle VM VirtualBox's own Virtual Disk Image (VDI) format, or in the third-party formats listed in Disk Image Files (VDI, VMDK, VHD, HDD).
- CD/DVD images in standard ISO format.
- Floppy images in standard RAW format.

For each image, the Virtual Media Manager shows you the full path of the image file and other information, such as the virtual machine the image is currently attached to.

The Virtual Media Manager enables you to do the following:

- **Add** an image to the known media.
- **Create** a new disk image.
  - For hard disks, the **Create Virtual Hard Disk** wizard is shown. See Creating a Virtual Hard Disk Image.
  - For optical disks, the **VISO Creator** tool is shown. See Creating a Virtual Optical Disk Image.
  - For floppy disks, the **Floppy Disk Creator** tool is shown. See Creating a Virtual Floppy Disk Image.
- **Copy** an image to create another one.

  For virtual hard disks, you can specify one of the following target types: VDI, VHD, or VMDK.
- **Move** an image to another location.

  A file dialog prompts you for the new image file location.

  When you use the Virtual Media Manager to move a disk image, Oracle VM VirtualBox updates all related configuration files automatically.

> **Note:**
>
> Always use the Virtual Media Manager or the `VBoxManage modifymedium` command to move a disk image.
>
> If you use a file management feature of the host OS to move a disk image to a new location, run the `VBoxManage modifymedium --setlocation` command to configure the new path of the disk image on the host file system. This command updates the Oracle VM VirtualBox configuration automatically.

- **Remove** an image from the known media. You can optionally delete the image file when removing the image.
- **Release** an image to detach it from a VM. This action only applies if the image is currently attached to a VM as a virtual hard disk.
- **Clear** all inaccessible disk images from the list. The disk images are released from the VMs they are attached to and removed from the known media.

> **Note:**
>
> This option is for optical disks and floppy disks only.

- **Search** for an image by name or UUID.
- View and edit the **Properties** of a disk image.

  Available properties include the following:

  - **Type:** Specifies the snapshot behavior of the disk. See Special Image Write Modes.
  - **Location:** Specifies the location of the disk image file on the host system. You can use a file dialog to browse for the disk image location.
  - **Description:** Specifies a short description of the disk image.
  - **Size:** Specifies the size of the disk image. You can use the slider to increase or decrease the disk image size.
  - **Information:** Specifies detailed information about the disk image.
- **Refresh** the property values of the selected disk image.

To perform these actions, highlight the medium in the Virtual Media Manager and then do one of the following:

- Click an icon in the Virtual Media Manager toolbar.
- Right-click the medium and select an option.

Use the **Storage** page in a VM's **Settings** window to create a new disk image. By default, disk images are stored in the VM's folder.

You can copy hard disk image files to other host systems and then import them in to VMs from the host system. However, some Windows guest OSes may require that you configure the new VM in a similar way to the old one.

> **Note:**
>
> Do not simply make copies of virtual disk images. If you import such a second copy into a VM, Oracle VM VirtualBox issues an error because Oracle VM VirtualBox assigns a universally unique identifier (UUID) to each disk image to ensure that it is only used one time. See Cloning Disk Images. Also, if you want to copy a VM to another system, use the Oracle VM VirtualBox import and export features. See Importing and Exporting Virtual Machines.

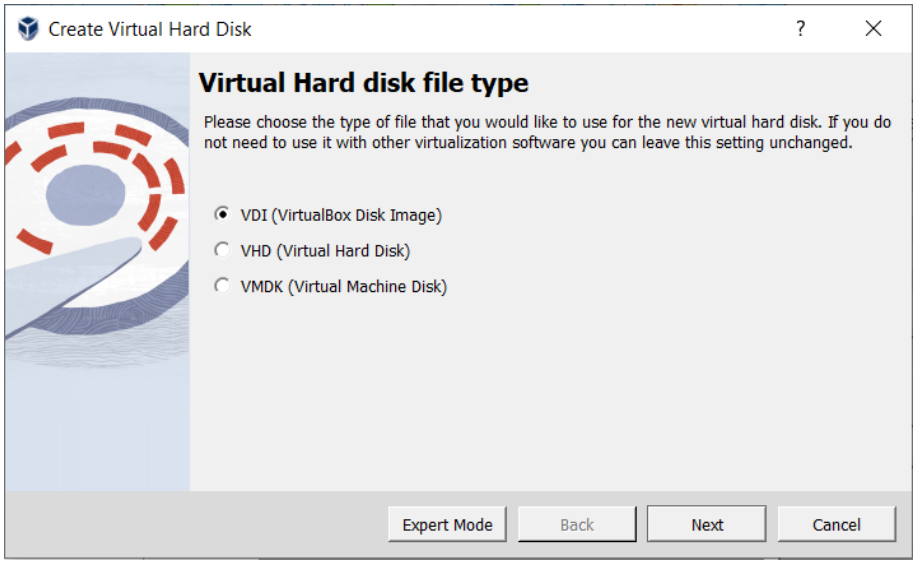
Creating a Virtual Hard Disk Image

Use the **Create Virtual Hard Disk** wizard to create a hard disk image.

1. Display the **Hard Disks** tab in Virtual Media Manager and click **Create**.

   The **Create Virtual Hard Disk** wizard is shown.

Figure 5-2 Create Virtual Hard Disk Wizard



2. On the **Virtual Hard Disk File Type** page, select a file type for the new virtual hard disk image.

   Click **Next**.

3. On the **Storage on Physical Hard Disk** page, select whether the size of the virtual hard disk file is dynamically allocated or is of fixed size.

   Click **Next**.

4. On the **File Location and Size** page, configure the location of the virtual hard disk file and use the slider to set the size limit for the virtual hard disk.

   Click **Finish** to create the virtual hard disk file.

   The virtual hard disk image is created in the specified location and added to the **Hard Disks** tab in Virtual Media Manager.

Creating a Virtual Optical Disk Image

Use the **VISO Creator** tool to create a virtual optical disk image. This enables you to create a virtual ISO from selected files on the host.

1. Display the **Optical Disks** tab in Virtual Media Manager and click **Create**.

   The **VISO Creator** tool is shown.

2. Create the virtual ISO file.

   a. Configure the name of the ISO file.

      Click **Configuration** and enter a name in the **Viso Name** field.

   b. Add files to your virtual ISO.

      In the **Host File System** pane, select files to copy from the host system to the virtual ISO.

      Click **Add Items To VISO**. The files are displayed in the **VISO Content** pane.

      The following file operations are also available:

      - To create folders on the virtual ISO, click **Create New Directory**.
      - To remove files from the virtual ISO, select files in the **VISO Content** pane and click **Remove Items From VISO**.
      - To remove *all* files from the virtual ISO, click **Reset the VISO Content**.

3. Create the virtual ISO image.

   Click **Create**.

   A virtual ISO file with the specified name and content is created.

Creating a Virtual Floppy Disk Image

Use the **Floppy Disk Creator** tool to create a floppy disk image.

1. Display the **Floppy Disks** tab in Virtual Media Manager and click **Create**.

   The **Floppy Disk Creator** tool is shown.

2. Configure the following settings:

   - **File Path:** The name and location of the floppy disk image.
   - **Size:** Select from the list of supported floppy disk sizes.
   - **Format Disk as FAT 12:** This is the default format used for most floppy disks. For an unformatted disk, do not select this option.

3. Create the floppy disk image file.

   Click **Create**.

   The floppy disk image is created in the specified location and added to the **Floppy Disks** tab in Virtual Media Manager.

Special Image Write Modes

For each virtual disk image supported by Oracle VM VirtualBox, you can determine separately how it should be affected by write operations from a virtual machine and snapshot operations.

This applies to all of the aforementioned image formats (VDI, VMDK, VHD, or HDD) and irrespective of whether an image is fixed-size or dynamically allocated.

By default, images are in *normal* mode. To mark an existing image with one of the non-standard modes listed below, use `VBoxManage modifymedium`. See VBoxManage modifymedium. Alternatively, use `VBoxManage storageattach` to attach the image to a VM and specify the `--mtype` argument. See VBoxManage storageattach.

The available virtual disk image modes are as follows:

- **Normal images** have no restrictions on how guests can read from and write to the disk. This is the default image mode.

  When you take a snapshot of your virtual machine as described in Snapshots, the state of a normal hard disk is recorded together with the snapshot, and when reverting to the snapshot, its state will be fully reset.

  The image file itself is not reset. Instead, when a snapshot is taken, Oracle VM VirtualBox *freezes* the image file and no longer writes to it. For the write operations from the VM, a second, *differencing* image file is created which receives only the changes to the original image. See Differencing Images.

  While you can attach the same normal image to more than one virtual machine, only one of these virtual machines attached to the same image file can be executed simultaneously, as otherwise there would be conflicts if several machines write to the same image file.

- **Write-through hard disks** are completely unaffected by snapshots. Their state is *not* saved when a snapshot is taken, and not restored when a snapshot is restored.

- **Shareable hard disks** are a variant of write-through hard disks. In principle they behave exactly the same. Their state is *not* saved when a snapshot is taken, and not restored when a snapshot is restored. The difference only shows if you attach such disks to several VMs. Shareable disks may be attached to several VMs which may run concurrently. This makes them suitable for use by cluster filesystems between VMs and similar applications which are explicitly prepared to access a disk concurrently. Only fixed size images can be used in this way, and dynamically allocated images are rejected.

  > **Caution:**
  >
  > This is an expert feature, and misuse can lead to data loss, as regular filesystems are not prepared to handle simultaneous changes by several parties.

- **Immutable images** only remember write accesses temporarily while the virtual machine is running. All changes are lost when the virtual machine is powered on the next time. As a result, as opposed to Normal images, the same immutable image can be used with several virtual machines without restrictions.

  Creating an immutable image makes little sense since it would be initially empty and lose its contents with every machine restart. You would have a disk that is always unformatted when the machine starts up. Instead, you can first create a normal image and then later mark it as immutable when you decide that the contents are useful.

  If you take a snapshot of a machine with immutable images, then on every machine power-up, those images are reset to the state of the last (current) snapshot, instead of the state of the original immutable image.

> **Note:**
>
> As a special exception, immutable images are *not* reset if they are attached to a machine in a saved state or whose last snapshot was taken while the machine was running. This is called an *online snapshot*. As a result, if the machine's current snapshot is an online snapshot, its immutable images behave exactly like the a normal image. To reenable the automatic resetting of such images, delete the current snapshot of the machine.

Oracle VM VirtualBox never writes to an immutable image directly at all. All write operations from the machine are directed to a differencing image. The next time the VM is powered on, the differencing image is reset so that every time the VM starts, its immutable images have exactly the same content.

The differencing image is only reset when the machine is powered on from within Oracle VM VirtualBox, not when you reboot by requesting a reboot from within the machine. This is also why immutable images behave as described above when snapshots are also present, which use differencing images as well.

If the automatic discarding of the differencing image on VM startup does not fit your needs, you can turn it off using the `autoreset` parameter of `VBoxManage modifymedium`. See VBoxManage modifymedium.

- **Multiattach mode images** can be attached to more than one virtual machine at the same time, even if these machines are running simultaneously. For each virtual machine to which such an image is attached, a differencing image is created. As a result, data that is written to such a virtual disk by one machine is not seen by the other machines to which the image is attached. Each machine creates its own write history of the multiattach image.

  Technically, a multiattach image behaves identically to an immutable image except the differencing image is not reset every time the machine starts.

  This mode is useful for sharing files which are almost never written, for instance picture galleries, where every guest changes only a small amount of data and the majority of the disk content remains unchanged. The modified blocks are stored in differencing images which remain relatively small and the shared content is stored only once at the host.

- **Read-only images** are used automatically for CD/DVD images, since CDs/DVDs can never be written to.

The following scenario illustrates the differences between the various image modes, with respect to snapshots.

Assume you have installed your guest OS in your VM, and you have taken a snapshot. Later, your VM is infected with a virus and you would like to go back to the snapshot. With a normal hard disk image, you simply restore the snapshot, and the earlier state of your hard disk image will be restored as well and your virus infection will be undone. With an immutable hard disk, all it takes is to shut down and power on your VM, and the virus infection will be discarded. With a write-through image however, you cannot easily undo the virus infection by means of virtualization, but will have to disinfect your virtual machine like a real computer.

You might find write-through images useful if you want to preserve critical data irrespective of snapshots. As you can attach more than one image to a VM, you may want to have one immutable image for the OS and one write-through image for your data files.

Differencing Images

The previous section mentioned differencing images and how they are used with snapshots, immutable images, and multiple disk attachments. This section describes in more detail how differencing images work.

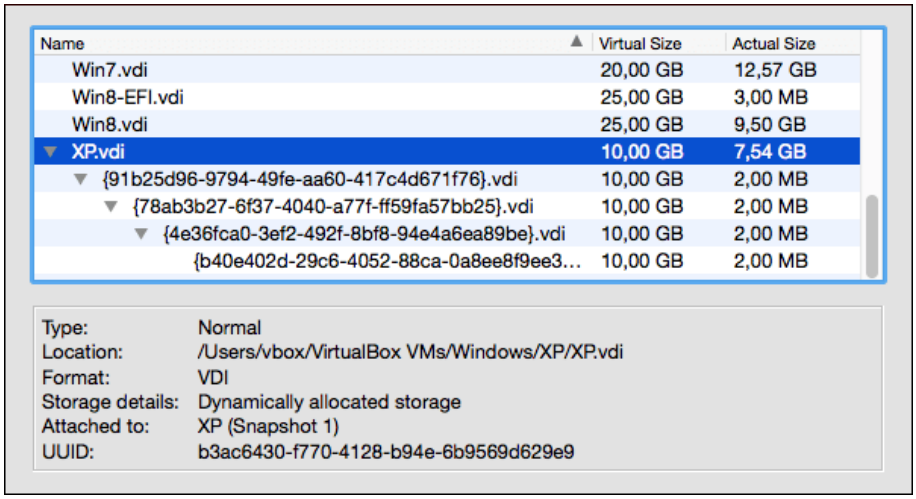
A differencing image is a special disk image that only holds the differences to another image. A differencing image by itself is useless, it must always refer to another image. The differencing image is then typically referred to as a *child*, which holds the differences to its *parent*.

When a differencing image is active, it receives all write operations from the virtual machine instead of its parent. The differencing image only contains the sectors of the virtual hard disk that have changed since the differencing image was created. When the machine reads a sector from such a virtual hard disk, it looks into the differencing image first. If the sector is present, it is returned from there. If not, Oracle VM VirtualBox looks into the parent. In other words, the parent becomes *read-only*. It is never written to again, but it is read from if a sector has not changed.

Differencing images can be chained. If another differencing image is created for a virtual disk that already has a differencing image, then it becomes a *grandchild* of the original parent. The first differencing image then becomes read-only as well, and write operations only go to the second-level differencing image. When reading from the virtual disk, Oracle VM VirtualBox needs to look into the second differencing image first, then into the first if the sector was not found, and then into the original image.

There can be an unlimited number of differencing images, and each image can have more than one child. As a result, the differencing images can form a complex tree with parents, siblings, and children, depending on how complex your machine configuration is. Write operations always go to the one *active* differencing image that is attached to the machine, and for read operations, Oracle VM VirtualBox may need to look up all the parents in the chain until the sector in question is found. You can view such a tree in the Virtual Media Manager.

Figure 5-3 Differencing Images, Shown in Virtual Media Manager



In all of these situations, from the point of view of the virtual machine, the virtual hard disk behaves like any other disk. While the virtual machine is running, there is a slight run-time I/O overhead because Oracle VM VirtualBox might need to look up sectors several times. This is

not noticeable however since the tables with sector information are always kept in memory and can be looked up quickly.

Differencing images are used in the following situations:

- **Snapshots.** When you create a snapshot, as explained in the previous section, Oracle VM VirtualBox *freezes* the images attached to the virtual machine and creates differencing images for each image that is not in *write-through* mode. From the point of view of the virtual machine, the virtual disks continue to operate before, but all write operations go into the differencing images. Each time you create another snapshot, for each hard disk attachment, another differencing image is created and attached, forming a chain or tree.

  In the above screenshot, you see that the original disk image is now attached to a snapshot, representing the state of the disk when the snapshot was taken.

  If you *restore* a snapshot, and want to go back to the exact machine state that was stored in the snapshot, the following happens:

  – Oracle VM VirtualBox copies the virtual machine settings that were copied into the snapshot back to the virtual machine. As a result, if you have made changes to the machine configuration since taking the snapshot, they are undone.

  – If the snapshot was taken while the machine was running, it contains a saved machine state, and that state is restored as well. After restoring the snapshot, the machine will then be in Saved state and resume execution from there when it is next started. Otherwise the machine will be in Powered Off state and do a full boot.

  – For each disk image attached to the machine, the differencing image holding all the write operations since the current snapshot was taken is thrown away, and the original parent image is made active again. If you restored the root snapshot, then this will be the root disk image for each attachment. Otherwise, some other differencing image descended from it. This effectively restores the old machine state.

  If you later *delete* a snapshot in order to free disk space, for each disk attachment, one of the differencing images becomes obsolete. In this case, the differencing image of the disk attachment cannot simply be deleted. Instead, Oracle VM VirtualBox needs to look at each sector of the differencing image and needs to copy it back into its parent. This is called "merging" images and can be a potentially lengthy process, depending on how large the differencing image is. It can also temporarily need a considerable amount of extra disk space, before the differencing image obsoleted by the merge operation is deleted.

- **Immutable images.** When an image is switched to immutable mode, a differencing image is created as well. As with snapshots, the parent image then becomes read-only, and the differencing image receives all the write operations. Every time the virtual machine is started, all the immutable images which are attached to it have their respective differencing image thrown away, effectively resetting the virtual machine's virtual disk with every restart.

Cloning Disk Images

You can duplicate hard disk image files on the same host to quickly produce a second virtual machine with the same OS setup. However, you should *only* make copies of virtual disk images using the utility supplied with Oracle VM VirtualBox. See VBoxManage clonemedium. This is because Oracle VM VirtualBox assigns a UUID to each disk image, which is also stored inside the image, and Oracle VM VirtualBox will refuse to work with two images that use the same number. If you do accidentally try to reimport a disk image which you copied normally, you can make a second copy using the `VBoxManage clonevm` command and import that instead.

Note that Linux distributions identify the boot hard disk from the ID of the drive. The ID Oracle VM VirtualBox reports for a drive is determined from the UUID of the virtual disk image. So if

you clone a disk image and try to boot the copied image the guest might not be able to determine its own boot disk as the UUID changed. In this case you have to adapt the disk ID in your boot loader script, for example `/boot/grub/menu.lst`. The disk ID looks like the following:

```
scsi-SATA_VBOX_HARDDISK_VB5cfdb1e2-c251e503
```

The ID for the copied image can be determined as follows:

```
hdparm -i /dev/sda
```

Host Input/Output Caching

Oracle VM VirtualBox can optionally disable the I/O caching that the host OS would otherwise perform on disk image files.

Traditionally, Oracle VM VirtualBox has opened disk image files as normal files, which results in them being cached by the host OS like any other file. The main advantage of this is speed: when the guest OS writes to disk and the host OS cache uses delayed writing, the write operation can be reported as completed to the guest OS quickly while the host OS can perform the operation asynchronously. Also, when you start a VM a second time and have enough memory available for the OS to use for caching, large parts of the virtual disk may be in system memory, and the VM can access the data much faster.

Note that this applies only to image files. Buffering does not occur for virtual disks residing on remote iSCSI storage, which is the more common scenario in enterprise-class setups. See iSCSI Servers.

While buffering is a useful default setting for virtualizing a few machines on a desktop computer, there are some disadvantages to this approach:

- Delayed writing through the host OS cache is less secure. When the guest OS writes data, it considers the data written even though it has not yet arrived on a physical disk. If for some reason the write does not happen, such as power failure or host crash, the likelihood of data loss increases.
- Disk image files tend to be very large. Caching them can therefore quickly use up the entire host OS cache. Depending on the efficiency of the host OS caching, this may slow down the host immensely, especially if several VMs run at the same time. For example, on Linux hosts, host caching may result in Linux delaying all writes until the host cache is nearly full and then writing out all these changes at once, possibly stalling VM execution for minutes. This can result in I/O errors in the guest as I/O requests time out there.
- Physical memory is often wasted as guest OSes typically have their own I/O caches, which may result in the data being cached twice, in both the guest and the host caches, for little effect.

If you decide to disable host I/O caching for the above reasons, Oracle VM VirtualBox uses its own small cache to buffer writes, but no read caching since this is typically already performed by the guest OS. In addition, Oracle VM VirtualBox fully supports asynchronous I/O for its virtual SATA, SCSI, and SAS controllers through multiple I/O threads.

Since asynchronous I/O is not supported by IDE controllers, for performance reasons, you may want to leave host caching enabled for your VM's virtual IDE controllers.

For this reason, Oracle VM VirtualBox enables you to configure whether the host I/O cache is used for each I/O controller separately. Either select the **Use Host I/O Cache** check box in the **Storage** settings for a given virtual storage controller, or use the following `VBoxManage` command to disable the host I/O cache for a virtual storage controller:

```
VBoxManage storagectl "VM name" --name <controllername> --hostiocache off
```

See VBoxManage storagectl.

For the above reasons, Oracle VM VirtualBox uses SATA controllers by default for new virtual machines.

Limiting Bandwidth for Disk Images

Oracle VM VirtualBox supports limiting of the maximum bandwidth used for asynchronous I/O. Additionally it supports sharing limits through bandwidth groups for several images. It is possible to have more than one such limit.

Limits are configured using `VBoxManage`. The example below creates a bandwidth group named Limit, sets the limit to 20 MB per second, and assigns the group to the attached disks of the VM:

```
VBoxManage bandwidthctl "VM name" add Limit --type disk --limit 20M
VBoxManage storageattach "VM name" --storagectl "SATA" --port 0 --device 0 --type hdd
                                   --medium disk1.vdi --bandwidthgroup Limit
VBoxManage storageattach "VM name" --storagectl "SATA" --port 1 --device 0 --type hdd
                                   --medium disk2.vdi --bandwidthgroup Limit
```

All disks in a group share the bandwidth limit, meaning that in the example above the bandwidth of both images combined can never exceed 20 MBps. However, if one disk does not require bandwidth the other can use the remaining bandwidth of its group.

The limits for each group can be changed while the VM is running, with changes being picked up immediately. The example below changes the limit for the group created in the example above to 10 MBps:

```
VBoxManage bandwidthctl "VM name" set Limit --limit 10M
```

CD/DVD Support

Virtual CD/DVD drives by default support only reading. The medium configuration is changeable at runtime. You can select between the following options to provide the medium data:

- **Host Drive** defines that the guest can read from the medium in the host drive.
- **Image file** gives the guest read-only access to the data in the image. This is typically an ISO file.
- **Empty** means a drive without an inserted medium.

Changing between the above, or changing a medium in the host drive that is accessed by a machine, or changing an image file will signal a medium change to the guest OS. The guest OS can then react to the change, for example by starting an installation program.

Medium changes can be prevented by the guest, and Oracle VM VirtualBox reflects that by locking the host drive if appropriate. You can force a medium removal in such situations by using the VirtualBox Manager or the `VBoxManage` command line tool. Effectively this is the equivalent of the emergency eject which many CD/DVD drives provide, with all associated side effects. The guest OS can issue error messages, just like on real hardware, and guest applications may misbehave. Use this with caution.

> **Note:**
>
> The identification string of the drive provided to the guest, displayed by configuration tools such as the Windows Device Manager, is always VBOX CD-ROM, irrespective of the current configuration of the virtual drive. This is to prevent hardware detection from being triggered in the guest OS every time the configuration is changed.

The standard CD/DVD emulation enables reading of standard data CD and DVD formats only. As an experimental feature, for additional capabilities, it is possible to give the guest direct access to the CD/DVD host drive by enabling *passthrough* mode. Depending on the host hardware, this may potentially enable the following things to work:

- CD/DVD writing from within the guest, if the host DVD drive is a CD/DVD writer
- Playing audio CDs
- Playing encrypted DVDs

To enable host drive passthrough you can use the `--passthrough` option of the `VBoxManage storageattach` command. See VBoxManage storageattach.

Even if passthrough is enabled, unsafe commands, such as updating the drive firmware, will be blocked. Video CD formats are never supported, not even in passthrough mode, and cannot be played from a virtual machine.

On Oracle Solaris hosts, passthrough requires running Oracle VM VirtualBox with real root permissions due to security measures enforced by the host.

iSCSI Servers

iSCSI stands for *Internet SCSI* and is a standard that supports use of the SCSI protocol over Internet (TCP/IP) connections. Especially with the advent of Gigabit Ethernet, it has become affordable to attach iSCSI storage servers simply as remote hard disks to a computer network. In iSCSI terminology, the server providing storage resources is called an *iSCSI target*, while the client connecting to the server and accessing its resources is called an *iSCSI initiator*.

Oracle VM VirtualBox can transparently present iSCSI remote storage to a virtual machine as a virtual hard disk. The guest OS will not see any difference between a virtual disk image (VDI file) and an iSCSI target. To achieve this, Oracle VM VirtualBox has an integrated iSCSI initiator.

Oracle VM VirtualBox's iSCSI support has been developed according to the iSCSI standard and should work with all standard-conforming iSCSI targets. To use an iSCSI target with Oracle VM VirtualBox, you must use the command line. See VBoxManage storageattach.

vboximg-mount: A Utility for FUSE Mounting a Virtual Disk Image

`vboximg-mount` is a command line utility for Mac OS and Linux hosts that provides raw access to an Oracle VM VirtualBox virtual disk image on the host system. Use this utility to mount, view, and optionally modify the disk image contents.

The utility is based on Filesystem in Userspace (FUSE) technology and uses the VirtualBox runtime engine. Ensure that Oracle VM VirtualBox is running on the host system.

> **Note:**
>
> When using `vboximg-mount`, ensure that the following conditions apply:
>
> - The disk image is not being used by any other systems, such as by guest VMs.
> - No VMs are running on the host system.

Raw access using FUSE is preferred over direct loopback mounting of virtual disk images, because it is snapshot aware. It can selectively merge disk differencing images in an exposed virtual hard disk, providing historical or up-to-date representations of the virtual disk contents.

`vboximg-mount` enables you to view information about registered VMs, their attached disk media, and any snapshots. Also, you can view partition information for a disk image.

The `vboximg-mount` command includes experimental read-only access to file systems inside a VM disk image. This feature enables you to extract some files from the disk image without starting the VM and without requiring third-party file system drivers on the host system. FAT, NTFS, ext2, ext3, and ext4 file systems are supported.

Use the `--help` option to view information about the `vboximg-mount` command usage. The complete command reference is described in vboximg-mount.

When `vboximg-mount` mounts an Oracle VM VirtualBox disk image, it creates a one level deep file system at a mount point that you specify. The file system includes a device node that represents the synthesized disk image as a readable or readable-writeable bytestream. This bytestream can be mounted either by using the host OS or by using other FUSE-based file systems.

Viewing Detailed Information About a Virtual Disk Image

The following examples show how to use the `vboximg-mount` command to view information about virtual disk images.

The following command outputs detailed information about all registered VMs and associated snapshots:

```
$ vboximg-mount --list --verbose

    ------------------------------------------------------
    VM Name:   "macOS High Sierra 10.13"
    UUID:      3887d96d-831c-4187-a55a-567c504ff0e1
    Location:  /Volumes/work/vm_guests/macOS High Sierra 10.13/macOS High Sierra
10.13.vbox
       -----------------------
       HDD base:   "macOS High Sierra 10.13.vdi"
       UUID:       f9ea7173-6869-4aa9-b487-68023a655980
       Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/macOS High Sierra
10.13.vdi

         Diff 1:
              UUID:       98c2bac9-cf37-443d-a935-4e879b70166d
              Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/
              Snapshots/{98c2bac9-cf37-443d-a935-4e879b70166d}.vdi
         Diff 2:
              UUID:       f401f381-7377-40b3-948e-3c61241b1a42
              Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/
              Snapshots/{f401f381-7377-40b3-948e-3c61241b1a42}.vdi
```

```
   ----------------------
   HDD base:   "simple_fixed_disk.vdi"
   UUID:       ffba4d7e-1277-489d-8173-22ca7660773d
   Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/simple_fixed_disk.vdi

     Diff 1:
          UUID:       aecab681-0d2d-468b-8682-93f79dc97a48
          Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/
          Snapshots/{aecab681-0d2d-468b-8682-93f79dc97a48}.vdi
     Diff 2:
          UUID:       70d6b34d-8422-47fa-8521-3b6929a1971c
          Location:   /Volumes/work/vm_guests/macOS High Sierra 10.13/
          Snapshots/{70d6b34d-8422-47fa-8521-3b6929a1971c}.vdi
-------------------------------------------------------
VM Name:   "debian"
UUID:      5365ab5f-470d-44c0-9863-dad532ee5905
Location:  /Volumes/work/vm_guests/debian/debian.vbox
   ----------------------
   HDD base:   "debian.vdi"
   UUID:       96d2e92e-0d4e-46ab-a0f1-008fdbf997e7
   Location:   /Volumes/work/vm_guests/debian/ol7.vdi

      Diff 1:
          UUID:       f9cc866a-9166-42e9-a503-bbfe9b7312e8
          Location:   /Volumes/work/vm_guests/debian/Snapshots/
          {f9cc866a-9166-42e9-a503-bbfe9b7312e8}.vdi
```

The following command outputs partition information about the specified disk image:

```
$ vboximg-mount --image=f9ea7173-6869-4aa9-b487-68023a655980 --list

    Virtual disk image:

       Path: /Volumes/work/vm_guests/macOS High Sierra 10.13/macOS High Sierra 10.13.vdi
       UUID: f9ea7173-6869-4aa9-b487-68023a655980

      #     Start  Sectors     Size       Offset  Type
      1        40  409599    199.9M        20480  EFI System
      2    409640  67453071   32.1G    209735680  Hierarchical File System Plus (HFS+)
      3  67862712  1269535   107.8M  34745708544  Apple Boot (Recovery HD)
```

Mounting a Virtual Disk Image

The following steps show how to use the `vboximg-mount` command to mount a partition of a virtual disk image on the host OS.

1. Create a mount point on the host OS. For example:

   ```
   $ mkdir macos_sysdisk
   ```

2. Show partition information about the virtual disk image.

   ```
   $ vboximg-mount --image=uuid --list
   ```

   where *uuid* is the UUID of the disk image.

3. Use `vboximg-mount` to perform a FUSE mount of a partition on the virtual disk image. For example:

   ```
   $ vboximg-mount --image=uuid -p 2 macos_sysdisk
   ```

   where *uuid* is the UUID for the disk image.

In this example, partition 2 is mounted on the `macos_sysdisk` mount point. The mount includes all snapshots for the disk image.

4. Use the host OS to mount the `vhdd` device node. The FUSE-mounted device node represents the virtual disk image.

```
$ ls macos_sysdisk
   macOS High Sierra 10.13.vdi  vhdd
$ sudo mount macos_sysdisk/vhdd /mnt
```

6 Virtual Networking

As mentioned in Network Settings, Oracle VM VirtualBox provides up to eight virtual PCI Ethernet cards for each virtual machine. For each such card, you can individually select the following:

- The hardware that will be virtualized.
- The virtualization mode that the virtual card operates in, with respect to your physical networking hardware on the host.

Four of the network cards can be configured in the **Network** section of the **Settings** window in VirtualBox Manager. You can configure all eight network cards on the command line using `VBoxManage modifyvm`. See VBoxManage modifyvm.

This chapter explains the various networking settings in more detail.

Virtual Networking Hardware

For each card, you can individually select what kind of *hardware* will be presented to the virtual machine. Oracle VM VirtualBox can virtualize the following types of networking hardware:

- AMD PCNet PCI II (Am79C970A)
- AMD PCNet FAST III (Am79C973), the default setting
- Intel PRO/1000 MT Desktop (82540EM)
- Intel PRO/1000 T Server (82543GC)
- Intel PRO/1000 MT Server (82545EM)
- Paravirtualized network adapter (virtio-net)

The PCNet FAST III is the default because it is supported by nearly all operating systems, as well as by the GNU GRUB boot manager. As an exception, the Intel PRO/1000 family adapters are chosen for some guest operating system types that no longer ship with drivers for the PCNet card, such as Windows Vista.

The Intel PRO/1000 MT Desktop type works with Windows Vista and later versions. The T Server variant of the Intel PRO/1000 card is recognized by Windows XP guests without additional driver installation. The MT Server variant facilitates OVF imports from other platforms.

The Paravirtualized network adapter (virtio-net) is special. If you select this adapter, then Oracle VM VirtualBox does *not* virtualize common networking hardware that is supported by common guest operating systems. Instead, Oracle VM VirtualBox expects a special software interface for virtualized environments to be provided by the guest, thus avoiding the complexity of emulating networking hardware and improving network performance. Oracle VM VirtualBox provides support for the industry-standard *virtio* networking drivers, which are part of the open source KVM project.

The virtio networking drivers are available for the following guest operating systems:

- Linux kernels version 2.6.25 or later can be configured to provide virtio support. Some distributions have also back-ported virtio to older kernels.

- For Windows 2000, XP, and Vista, virtio drivers can be downloaded and installed from the KVM project web page:

  http://www.linux-kvm.org/page/WindowsGuestDrivers.

Oracle VM VirtualBox also has limited support for *jumbo frames*. These are networking packets with more than 1500 bytes of data, provided that you use the Intel card virtualization and bridged networking. Jumbo frames are not supported with the AMD networking devices. In those cases, jumbo packets will silently be dropped for both the transmit and the receive direction. Guest operating systems trying to use this feature will observe this as a packet loss, which may lead to unexpected application behavior in the guest. This does not cause problems with guest operating systems in their default configuration, as jumbo frames need to be explicitly enabled.

Introduction to Networking Modes

Each of the networking adapters can be separately configured to operate in one of the following modes:

- **Not attached.** In this mode, Oracle VM VirtualBox reports to the guest that a network card is present, but that there is no connection. This is as if no Ethernet cable was plugged into the card. Using this mode, it is possible to *pull* the virtual Ethernet cable and disrupt the connection, which can be useful to inform a guest operating system that no network connection is available and enforce a reconfiguration.
- **Network Address Translation (NAT)**. If all you want is to browse the Web, download files, and view email inside the guest, then this default mode should be sufficient for you, and you can skip the rest of this section. Please note that there are certain limitations when using Windows file sharing. See NAT Limitations.
- **NAT Network.** A NAT network is a type of internal network that allows outbound connections. See Network Address Translation Service.
- **Bridged networking.** This is for more advanced networking needs, such as network simulations and running servers in a guest. When enabled, Oracle VM VirtualBox connects to one of your installed network cards and exchanges network packets directly, circumventing your host operating system's network stack.
- **Internal networking.** This can be used to create a different kind of software-based network which is visible to selected virtual machines, but not to applications running on the host or to the outside world.
- **Host-only networking.** This can be used to create a network containing the host and a set of virtual machines, without the need for the host's physical network interface. Instead, a virtual network interface, similar to a loopback interface, is created on the host, providing connectivity among virtual machines and the host.
- **Cloud networking.** This can be used to connect a local VM to a subnet on a remote cloud service.
- **Generic networking.** Rarely used modes which share the same generic network interface, by allowing the user to select a driver which can be included with Oracle VM VirtualBox or be distributed in an extension pack.

  The following sub-modes are available:

  – **UDP Tunnel:** Used to interconnect virtual machines running on different hosts directly, easily, and transparently, over an existing network infrastructure.

  – **VDE (Virtual Distributed Ethernet) networking:** Used to connect to a Virtual Distributed Ethernet switch on a Linux or a FreeBSD host. At the moment this option

requires compilation of Oracle VM VirtualBox from sources, as the Oracle packages do not include it.

The following table provides an overview of the most important networking modes.

Table 6-1 Overview of Networking Modes

Mode	VM → Host	VM ← Host	VM1 ↔ VM2	VM → Net/LAN	VM ← Net/LAN
Host-only	+	+	+	–	–
Internal	–	–	+	–	–
Bridged	+	+	+	+	+
NAT	+	Port forward	–	+	Port forward
NATservice	+	Port forward	+	+	Port forward

The following sections describe the available network modes in more detail.

Network Address Translation (NAT)

Network Address Translation (NAT) is the simplest way of accessing an external network from a virtual machine. Usually, it does not require any configuration on the host network and guest system. For this reason, it is the default networking mode in Oracle VM VirtualBox.

A virtual machine with NAT enabled acts much like a real computer that connects to the Internet through a router. The router, in this case, is the Oracle VM VirtualBox networking engine, which maps traffic from and to the virtual machine transparently. In Oracle VM VirtualBox this router is placed between each virtual machine and the host. This separation maximizes security since by default virtual machines cannot talk to each other.

The disadvantage of NAT mode is that, much like a private network behind a router, the virtual machine is invisible and unreachable from the outside internet. You cannot run a server this way unless you set up port forwarding. See Configuring Port Forwarding with NAT.

The network frames sent out by the guest operating system are received by Oracle VM VirtualBox's NAT engine, which extracts the TCP/IP data and resends it using the host operating system. To an application on the host, or to another computer on the same network as the host, it looks like the data was sent by the Oracle VM VirtualBox application on the host, using an IP address belonging to the host. Oracle VM VirtualBox listens for replies to the packages sent, and repacks and resends them to the guest machine on its private network.

> **Note:**
>
> Even though the NAT engine separates the VM from the host, the VM has access to the host's loopback interface and the network services running on it. The host's loopback interface is accessible as IP address 10.0.2.2. This access to the host's loopback interface can be extremely useful in some cases, for example when running a web application under development in the VM and the database server on the loopback interface on the host.

The virtual machine receives its network address and configuration on the private network from a DHCP server integrated into Oracle VM VirtualBox. The IP address thus assigned to the virtual machine is usually on a completely different network than the host. As more than one card of a virtual machine can be set up to use NAT, the first card is connected to the private

network 10.0.2.0, the second card to the network 10.0.3.0 and so on. If you need to change the guest-assigned IP range, see Fine Tuning the Oracle VM VirtualBox NAT Engine.

Configuring Port Forwarding with NAT

As the virtual machine is connected to a private network internal to Oracle VM VirtualBox and invisible to the host, network services on the guest are not accessible to the host machine or to other computers on the same network. However, like a physical router, Oracle VM VirtualBox can make selected services available to the world outside the guest through *port forwarding*. This means that Oracle VM VirtualBox listens to certain ports on the host and resends all packets which arrive there to the guest, on the same or a different port.

To an application on the host or other physical or virtual machines on the network, it looks as though the service being proxied is actually running on the host. This also means that you cannot run the same service on the same ports on the host. However, you still gain the advantages of running the service in a virtual machine. For example, services on the host machine or on other virtual machines cannot be compromised or crashed by a vulnerability or a bug in the service, and the service can run in a different operating system than the host system.

To configure port forwarding you can use the graphical **Port Forwarding** editor which can be found in the **Network** settings dialog for network adaptors configured to use NAT. Here, you can map host ports to guest ports to allow network traffic to be routed to a specific port in the guest.

Alternatively, the command line tool `VBoxManage` can be used. See VBoxManage modifyvm.

You will need to know which ports on the guest the service uses and to decide which ports to use on the host. You may want to use the same ports on the guest and on the host. You can use any ports on the host which are not already in use by a service. For example, to set up incoming NAT connections to an `ssh` server in the guest, use the following command:

```
VBoxManage modifyvm "VM name" --nat-pf1 "guestssh,tcp,,2222,,22"
```

In the above example, all TCP traffic arriving on port 2222 on any host interface will be forwarded to port 22 in the guest. The protocol name `tcp` is a mandatory attribute defining which protocol should be used for forwarding, `udp` could also be used. The name `guestssh` is purely descriptive and will be auto-generated if omitted. The number after `--nat-pf` denotes the network card, as with other `VBoxManage` commands.

To remove this forwarding rule, use the following command:

```
VBoxManage modifyvm "VM name" --natpf1 delete "guestssh"
```

If for some reason the guest uses a static assigned IP address not leased from the built-in DHCP server, it is required to specify the guest IP when registering the forwarding rule, as follows:

```
VBoxManage modifyvm "VM name" --natpf1 "guestssh,tcp,,2222,10.0.2.19,22"
```

This example is identical to the previous one, except that the NAT engine is being told that the guest can be found at the 10.0.2.19 address.

To forward *all* incoming traffic from a specific host interface to the guest, specify the IP of that host interface as follows:

```
VBoxManage modifyvm "VM name" --natpf1 "guestssh,tcp,127.0.0.1,2222,,22"
```

This example forwards all TCP traffic arriving on the localhost interface at 127.0.0.1 through port 2222 to port 22 in the guest.

It is possible to configure incoming NAT connections while the VM is running, see VBoxManage controlvm.

PXE Booting with NAT

PXE booting is now supported in NAT mode. The NAT DHCP server provides a boot file name of the form `vmname.pxe` if the directory `TFTP` exists in the directory where the user's `VirtualBox.xml` file is kept. It is the responsibility of the user to provide `vmname.pxe`.

NAT Limitations

There are some limitations of NAT mode which users should be aware of, as follows:

- **ICMP protocol limitations.** Some frequently used network debugging tools, such as `ping` or `traceroute`, rely on the ICMP protocol for sending and receiving messages. Oracle VM VirtualBox ICMP support has some limitations, meaning `ping` should work but some other tools may not work reliably.
- **Receiving of UDP broadcasts.** The guest does not reliably receive UDP broadcasts. In order to save resources, it only listens for a certain amount of time after the guest has sent UDP data on a particular port. As a consequence, NetBios name resolution based on broadcasts does not always work, but WINS always works. As a workaround, you can use the numeric IP of the desired server in the `\\server\share` notation.
- **Some protocols are not supported.** Protocols other than TCP and UDP are not supported. GRE is not supported. This means some VPN products, such as PPTP from Microsoft, cannot be used. There are other VPN products which use only TCP and UDP.
- **Forwarding host ports below 1024.** On UNIX-based hosts, such as Linux, Oracle Solaris, and macOS, it is not possible to bind to ports below 1024 from applications that are not run by `root`. As a result, if you try to configure such a port forwarding, the VM will refuse to start.

These limitations normally do not affect standard network use. But the presence of NAT has also subtle effects that may interfere with protocols that are normally working. One example is NFS, where the server is often configured to refuse connections from non-privileged ports, which are those ports not below 1024.

Network Address Translation Service

The Network Address Translation (NAT) service works in a similar way to a home router, grouping the systems using it into a network and preventing systems outside of this network from directly accessing systems inside it, but letting systems inside communicate with each other and with systems outside using TCP and UDP over IPv4 and IPv6.

A NAT service is attached to an internal network. Virtual machines which are to make use of it should be attached to that internal network. The name of internal network is chosen when the NAT service is created and the internal network will be created if it does not already exist. The following is an example command to create a NAT network:

```
VBoxManage natnetwork add --netname natnet1 --network "192.168.15.0/24" --enable
```

Here, natnet1 is the name of the internal network to be used and 192.168.15.0/24 is the network address and mask of the NAT service interface. By default in this static configuration the gateway will be assigned the address 192.168.15.1, the address following the interface

address, though this is subject to change. To attach a DHCP server to the internal network, modify the example command as follows:

```
VBoxManage natnetwork add --netname natnet1 --network "192.168.15.0/24" --enable --dhcp
on
```

To add a DHCP server to an existing network, use the following command:

```
VBoxManage natnetwork modify --netname natnet1 --dhcp on
```

To disable the DHCP server, use the following command:

```
VBoxManage natnetwork modify --netname natnet1 --dhcp off
```

A DHCP server provides a list of registered nameservers, but does not map servers from the 127/8 network.

To start the NAT service, use the following command:

```
VBoxManage natnetwork start --netname natnet1
```

If the network has a DHCP server attached then it will start together with the NAT network service.

To stop the NAT network service, together with any DHCP server:

```
VBoxManage natnetwork stop --netname natnet1
```

To delete the NAT network service:

```
VBoxManage natnetwork remove --netname natnet1
```

This command does not remove the DHCP server if one is enabled on the internal network.

Port-forwarding is supported, using the `--port-forward-4` switch for IPv4 and `--port-forward-6` for IPv6. For example:

```
VBoxManage natnetwork modify \
  --netname natnet1 --port-forward-4 "ssh:tcp:[]:1022:[192.168.15.5]:22"
```

This adds a port-forwarding rule from the host's TCP 1022 port to the port 22 on the guest with IP address 192.168.15.5. Host port, guest port and guest IP are mandatory. To delete the rule, use the following command:

```
VBoxManage natnetwork modify --netname natnet1 --port-forward-4 delete ssh
```

It is possible to bind a NAT service to specified interface. For example:

```
VBoxManage setextradata global "NAT/win-nat-test-0/SourceIp4" 192.168.1.185
```

To see the list of registered NAT networks, use the following command:

```
VBoxManage list natnetworks
```

NAT networks can also be created, deleted, and configured using the Network Manager tool in VirtualBox Manager. Click **File**, **Tools**, **Network Manager**. See Network Manager.

> **Note:**
>
> Even though the NAT service separates the VM from the host, the VM has access to the host's loopback interface and the network services running on it. The host's loopback interface is accessible as IP address 10.0.2.2 (assuming the default configuration, in other configurations it's the respective address in the configured IPv4 or IPv6 network range). This access to the host's loopback interface can be extremely useful in some cases, for example when running a web application under development in the VM and the database server on the loopback interface on the host.

Bridged Networking

With bridged networking, Oracle VM VirtualBox uses a device driver on your *host* system that filters data from your physical network adapter. This driver is therefore called a *net filter* driver. This enables Oracle VM VirtualBox to intercept data from the physical network and inject data into it, effectively creating a new network interface in software. When a guest is using such a new software interface, it looks to the host system as though the guest were physically connected to the interface using a network cable. The host can send data to the guest through that interface and receive data from it. This means that you can set up routing or bridging between the guest and the rest of your network.

> **Note:**
>
> Even though TAP interfaces are no longer necessary on Linux for bridged networking, you *can* still use TAP interfaces for certain advanced setups, since you can connect a VM to any host interface.

To enable bridged networking, open the **Settings** dialog of a virtual machine, go to the **Network** page and select **Bridged Network** in the drop-down list for the **Attached To** field. Select a host interface from the list at the bottom of the page, which contains the physical network interfaces of your systems. On a typical MacBook, for example, this will allow you to select between en1: AirPort, which is the wireless interface, and en0: Ethernet, which represents the interface with a network cable.

> **Note:**
>
> Bridging to a wireless interface is done differently from bridging to a wired interface, because most wireless adapters do not support promiscuous mode. All traffic has to use the MAC address of the host's wireless adapter, and therefore Oracle VM VirtualBox needs to replace the source MAC address in the Ethernet header of an outgoing packet to make sure the reply will be sent to the host interface. When Oracle VM VirtualBox sees an incoming packet with a destination IP address that belongs to one of the virtual machine adapters it replaces the destination MAC address in the Ethernet header with the VM adapter's MAC address and passes it on. Oracle VM VirtualBox examines ARP and DHCP packets in order to learn the IP addresses of virtual machines.

Depending on your host operating system, the following limitations apply:

- **macOS hosts.** Functionality is limited when using AirPort, the Mac's wireless networking system, for bridged networking. Currently, Oracle VM VirtualBox supports only IPv4 and IPv6 over AirPort. For other protocols, such as IPX, you must choose a wired interface.
- **Linux hosts.** Functionality is limited when using wireless interfaces for bridged networking. Currently, Oracle VM VirtualBox supports only IPv4 and IPv6 over wireless. For other protocols, such as IPX, you must choose a wired interface.

  Also, setting the MTU to less than 1500 bytes on wired interfaces provided by the sky2 driver on the Marvell Yukon II EC Ultra Ethernet NIC is known to cause packet losses under certain conditions.

  Some adapters strip VLAN tags in hardware. This does not allow you to use VLAN trunking between VM and the external network with pre-2.6.27 Linux kernels, or with host operating systems other than Linux.
- **Oracle Solaris hosts.** There is no support for using wireless interfaces. Filtering guest traffic using IPFilter is also not completely supported due to technical restrictions of the Oracle Solaris networking subsystem. These issues may be addressed in later releases of Oracle Solaris 11.

  On Oracle Solaris 11 hosts build 159 and above, it is possible to use Oracle Solaris Crossbow Virtual Network Interfaces (VNICs) directly with Oracle VM VirtualBox without any additional configuration other than each VNIC must be exclusive for every guest network interface.

  When using VLAN interfaces with Oracle VM VirtualBox, they must be named according to the PPA-hack naming scheme, such as e1000g513001. Otherwise, the guest may receive packets in an unexpected format.

Internal Networking

Internal Networking is similar to bridged networking in that the VM can directly communicate with the outside world. However, the outside world is limited to other VMs on the same host which connect to the same internal network.

Even though technically, everything that can be done using internal networking can also be done using bridged networking, there are security advantages with internal networking. In bridged networking mode, all traffic goes through a physical interface of the host system. It is therefore possible to attach a packet sniffer such as Wireshark to the host interface and log all traffic that goes over it. If, for any reason, you prefer two or more VMs on the same machine to communicate privately, hiding their data from both the host system and the user, bridged networking therefore is not an option.

Internal networks are created automatically as needed. There is no central configuration. Every internal network is identified simply by its name. Once there is more than one active virtual network card with the same internal network ID, the Oracle VM VirtualBox support driver will automatically *wire* the cards and act as a network switch. The Oracle VM VirtualBox support driver implements a complete Ethernet switch and supports both broadcast/multicast frames and promiscuous mode.

In order to attach a VM's network card to an internal network, set its networking mode to Internal Networking. There are two ways to accomplish this:

- Use the VM's **Settings** window in VirtualBox Manager. In the **Network** category of the Settings window, select **Internal Network** from the drop-down list of networking modes. Select the name of an existing internal network from the drop-down list below, or enter a new name into the **Name** field.

- Use the command line, for example:

  ```
  VBoxManage modifyvm "VM name" --nic<x> intnet
  ```

  Optionally, you can specify a network name with the command:

  ```
  VBoxManage modifyvm "VM name" --intnet<x> "network name"
  ```

  If you do not specify a network name, the network card will be attached to the network `intnet` by default.

Unless you configure the virtual network cards in the guest operating systems that are participating in the internal network to use static IP addresses, you may want to use the DHCP server that is built into Oracle VM VirtualBox to manage IP addresses for the internal network. See VBoxManage dhcpserver.

As a security measure, by default, the Linux implementation of internal networking only allows VMs running under the same user ID to establish an internal network. However, it is possible to create a shared internal networking interface, accessible by users with different user IDs.

Host-Only Networking

Host-only networking can be thought of as a hybrid between the bridged and internal networking modes. As with bridged networking, the virtual machines can talk to each other and the host as if they were connected through a physical Ethernet switch. As with internal networking, a physical networking interface need not be present, and the virtual machines cannot talk to the world outside the host since they are not connected to a physical networking interface.

When host-only networking is used, Oracle VM VirtualBox creates a new software interface on the host which then appears next to your existing network interfaces. In other words, whereas with bridged networking an existing physical interface is used to attach virtual machines to, with host-only networking a new *loopback* interface is created on the host. And whereas with internal networking, the traffic between the virtual machines cannot be seen, the traffic on the loopback interface on the host can be intercepted.

> **Note:**
>
> Hosts running recent macOS versions do not support host-only adapters. These adapters are replaced by host-only networks, which define a network mask and an IP address range, where the host network interface receives the lowest address in the range.
>
> The host network interface gets added and removed dynamically by the operating system, whenever a host-only network is used by virtual machines.
>
> On macOS hosts, choose the **Host-Only Network** option when configuring a network adapter. The **Host-Only Adapter** option is provided for legacy support.

Host-only networking is particularly useful for preconfigured virtual appliances, where multiple virtual machines are shipped together and designed to cooperate. For example, one virtual machine may contain a web server and a second one a database, and since they are intended to talk to each other, the appliance can instruct Oracle VM VirtualBox to set up a host-only network for the two. A second, bridged, network would then connect the web server to the outside world to serve data to, but the outside world cannot connect to the database.

To enable a host-only network interface for a virtual machine, do either of the following:

- Go to the **Network** page in the virtual machine's **Settings** dialog and select an **Adapter** tab. Ensure that the **Enable Network Adapter** check box is selected and choose **Host-Only Adapter** for the **Attached To** field.
- On the command line, use `VBoxManage modifyvm vmname --nic x hostonly`. See VBoxManage modifyvm.

For host-only networking, as with internal networking, you may find the DHCP server useful that is built into Oracle VM VirtualBox. This is enabled by default and manages the IP addresses in the host-only network. Without the DHCP server you would need to configure all IP addresses statically.

- In VirtualBox Manager you can configure the DHCP server by choosing **File**, **Tools**, **Network Manager**. The Network Manager window lists all host-only networks which are presently in use. Select the network name and then use the **DHCP Server** tab to configure DHCP server settings. See Network Manager.
- Alternatively, you can use the `VBoxManage dhcpserver` command. See VBoxManage dhcpserver.

> **Note:**
>
> On Linux and macOS hosts the number of host-only interfaces is limited to 128. There is no such limit for Oracle Solaris and Windows hosts.

On Linux, macOS and Solaris Oracle VM VirtualBox will only allow IP addresses in 192.168.56.0/21 range to be assigned to host-only adapters. For IPv6 only link-local addresses are allowed. If other ranges are desired, they can be enabled by creating `/etc/vbox/networks.conf` and specifying allowed ranges there. For example, to allow 10.0.0.0/8 and 192.168.0.0/16 IPv4 ranges as well as 2001::/64 range put the following lines into `/etc/vbox/networks.conf`:

```
* 10.0.0.0/8 192.168.0.0/16
* 2001::/64
```

Lines starting with the hash `#` are ignored. The following example allows any addresses, effectively disabling range control:

```
* 0.0.0.0/0 ::/0
```

If the file exists, but no ranges are specified in it, no addresses will be assigned to host-only adapters. The following example effectively disables all ranges:

```
# No addresses are allowed for host-only adapters
```

UDP Tunnel Networking

This networking mode enables you to interconnect virtual machines running on different hosts.

Technically this is done by encapsulating Ethernet frames sent or received by the guest network card into UDP/IP datagrams, and sending them over any network available to the host.

UDP Tunnel mode has the following parameters:

- **Source UDP port:** The port on which the host listens. Datagrams arriving on this port from any source address will be forwarded to the receiving part of the guest network card.
- **Destination address:** IP address of the target host of the transmitted data.
- **Destination UDP port:** Port number to which the transmitted data is sent.

When interconnecting two virtual machines on two different hosts, their IP addresses must be swapped. On a single host, source and destination UDP ports must be swapped.

In the following example, host 1 uses the IP address 10.0.0.1 and host 2 uses IP address 10.0.0.2. To configure using the command-line:

```
VBoxManage modifyvm "VM 01 on host 1" --nic<x> generic
VBoxManage modifyvm "VM 01 on host 1" --nic-generic-drv<x> UDPTunnel
VBoxManage modifyvm "VM 01 on host 1" --nic-property<x> dest=10.0.0.2
VBoxManage modifyvm "VM 01 on host 1" --nic-property<x> sport=10001
VBoxManage modifyvm "VM 01 on host 1" --nic-property<x> dport=10002

VBoxManage modifyvm "VM 02 on host 2" --nic<y> generic
VBoxManage modifyvm "VM 02 on host 2" --nic-generic-drv<y> UDPTunnel
VBoxManage modifyvm "VM 02 on host 2" --nic-property<y> dest=10.0.0.1
VBoxManage modifyvm "VM 02 on host 2" --nic-property<y> sport=10002
VBoxManage modifyvm "VM 02 on host 2" --nic-property<y> dport=10001
```

Of course, you can always interconnect two virtual machines on the same host, by setting the destination address parameter to 127.0.0.1 on both. It will act similarly to an internal network in this case. However, the host can see the network traffic which it could not in the normal internal network case.

> **Note:**
>
> On UNIX-based hosts, such as Linux, Oracle Solaris, and Mac OS X, it is not possible to bind to ports below 1024 from applications that are not run by `root`. As a result, if you try to configure such a source UDP port, the VM will refuse to start.

VDE Networking

Virtual Distributed Ethernet (VDE) is a flexible, virtual network infrastructure system, spanning across multiple hosts in a secure way. It enables L2/L3 switching, including spanning-tree protocol, VLANs, and WAN emulation. It is an optional part of Oracle VM VirtualBox which is only included in the source code.

VDE is a project developed by Renzo Davoli, Associate Professor at the University of Bologna, Italy.

The basic building blocks of the infrastructure are VDE switches, VDE plugs, and VDE wires which interconnect the switches.

The Oracle VM VirtualBox VDE driver has a single parameter: VDE network. This is the name of the VDE network switch socket to which the VM will be connected.

The following basic example shows how to connect a virtual machine to a VDE switch.

1. Create a VDE switch:

```
vde_switch -s /tmp/switch1
```

2. Configure VMs using the command-line:

```
VBoxManage modifyvm "VM name" --nic<x> generic

VBoxManage modifyvm "VM name" --nic-generic-drv<x> VDE
```

To connect to an automatically allocated switch port:

```
VBoxManage modifyvm "VM name" --nic-property<x> network=/tmp/switch1
```

To connect to a specific switch port *n*:

```
VBoxManage modifyvm "VM name" --nic-property<x> network=/tmp/switch1[<n>]
```

This command can be useful for VLANs.

3. (Optional) Map between a VDE switch port and a VLAN.

Using the switch command line:

```
vde$ vlan/create <VLAN>

vde$ port/setvlan <port> <VLAN>
```

VDE is available on Linux and FreeBSD hosts only. It is only available if the VDE software and the VDE plugin library from the VirtualSquare project are installed on the host system.

> **Note:**
>
> For Linux hosts, the shared library libvdeplug.so must be available in the search path for shared libraries.

For more information on setting up VDE networks, please see the documentation accompanying the software. See also http://wiki.virtualsquare.org.

Cloud Networks

Cloud networks can be used for connections from a local VM to a subnet on a remote Oracle Cloud Infrastructure instance. See Cloud Networks Tab for details of how to create and configure a cloud network using the Network Manager tool in VirtualBox Manager.

To enable a cloud network interface for a virtual machine, do either of the following:

- Go to the **Network** page in the virtual machine's **Settings** dialog and select an **Adapter** tab. Ensure that the **Enable Network Adapter** check box is selected and choose **Cloud Network** for the **Attached To** field.
- On the command line, use `VBoxManage modifyvm vmname --nic x cloud`. See VBoxManage modifyvm.

Network Manager

The **Network Manager** tool in VirtualBox Manager enables you to create, delete, and configure the following types of networks used by Oracle VM VirtualBox:

- Host-only networks. See Host-Only Networks Tab.

- NAT networks. See NAT Networks Tab.
- Cloud networks. See Cloud Networks Tab.

To display the Network Manager, go to the global **Tools** menu and click **Network**.

Host-Only Networks Tab

The Host-Only Networks tab in Network Manager lists all host-only networks that are currently in use.

- Click **Create** to add a new host-only network to the list.
- Click **Remove** to remove a host-only network from the list.
- Click **Properties** to show or hide settings for the selected host-only network.

To configure a host-only network, select the network name in the **Name** field and do the following:

- Use the **Adapter** tab to configure the network adapter for the host-only network.
- Use the **DHCP Server** tab to configure settings for the DHCP server used by the host-only network. The DHCP server is built into Oracle VM VirtualBox and manages IP addresses for the network automatically.

NAT Networks Tab

The NAT Networks tab in Network Manager lists all NAT networks that are currently in use.

- Click **Create** to add a new NAT network to the list.
- Click **Remove** to remove a NAT network from the list.
- Click **Properties** to show or hide settings for the selected NAT network.

To configure a NAT network, select the network name in the **Name** field and do the following:

- Use the **General Options** tab to configure the network settings used by the NAT network. For example, the network address and mask of the NAT service interface.
- Use the **Port Forwarding** tab to configure port forwarding rules used by the NAT network.

Cloud Networks Tab

The Cloud Networks tab in Network Manager lists all cloud networks that are currently in use.

- Click **Create** to add a new cloud network to the list.
- Click **Remove** to remove a cloud network from the list.
- Click **Properties** to show or hide settings for the selected cloud network.

To configure a cloud network, select the network name in the **Name** field and specify the following:

- **Name:** The name used for the cloud network.
- **Provider:** The cloud service provider, such as Oracle Cloud Infrastructure.
- **Profile:** The cloud profile used to connect to the cloud network.
- **ID:** The OCID for the cloud tunneling network. Click the **Network** icon to view the subnets on Oracle Cloud Infrastructure that are available for tunneling traffic.

See Using a Cloud Network for details of how you can use the `VBoxManage cloud` command to create and configure a virtual cloud network (VCN) on Oracle Cloud Infrastructure.

Limiting Bandwidth for Network Input/Output

Oracle VM VirtualBox supports limiting of the maximum bandwidth used for network transmission. Several network adapters of one VM may share limits through bandwidth groups. It is possible to have more than one such limit.

> **Note:**
>
> Oracle VM VirtualBox shapes VM traffic only in the transmit direction, delaying the packets being sent by virtual machines. It does not limit the traffic being received by virtual machines.

Limits are configured through `VBoxManage`. The following example creates a bandwidth group named Limit, sets the limit to 20 Mbps and assigns the group to the first and second adapters of the VM:

```
VBoxManage bandwidthctl "VM name" add Limit --type network --limit 20m
VBoxManage modifyvm "VM name" --nicbandwidthgroup1 Limit
VBoxManage modifyvm "VM name" --nicbandwidthgroup2 Limit
```

All adapters in a group share the bandwidth limit, meaning that in the example above the bandwidth of both adapters combined can never exceed 20 Mbps. However, if one adapter does not require bandwidth the other can use the remaining bandwidth of its group.

The limits for each group can be changed while the VM is running, with changes being picked up immediately. The following example changes the limit for the group created in the previous example to 100 Kbps:

```
VBoxManage bandwidthctl "VM name" set Limit --limit 100k
```

To completely disable shaping for the first adapter of VM use the following command:

```
VBoxManage modifyvm "VM name" --nicbandwidthgroup1 none
```

It is also possible to disable shaping for all adapters assigned to a bandwidth group while VM is running, by specifying the zero limit for the group. For example, for the bandwidth group named Limit:

```
VBoxManage bandwidthctl "VM name" set Limit --limit 0
```

Improving Network Performance

Oracle VM VirtualBox provides a variety of virtual network adapters that can be attached to the host's network in a number of ways. Depending on which types of adapters and attachments are used the network performance will be different. Performance-wise the virtio network adapter is preferable over Intel PRO/1000 emulated adapters, which are preferred over the PCNet family of adapters. Both virtio and Intel PRO/1000 adapters enjoy the benefit of segmentation and checksum offloading. Segmentation offloading is essential for high performance as it allows for less context switches, dramatically increasing the sizes of packets that cross the VM/host boundary.

> **Note:**
>
> Neither virtio nor Intel PRO/1000 drivers for Windows XP support segmentation offloading. Therefore Windows XP guests never reach the same transmission rates as other guest types. Refer to MS Knowledge base article 842264 for additional information.

Three attachment types: Internal, Bridged, and Host-Only, have nearly identical performance. The Internal type is a little bit faster and uses less CPU cycles as the packets never reach the host's network stack. The NAT attachment type is the slowest and most secure of all attachment types, as it provides network address translation. The generic driver attachment is special and cannot be considered as an alternative to other attachment types.

The number of CPUs assigned to VM does not improve network performance and in some cases may hurt it due to increased concurrency in the guest.

Here is a short summary of things to check in order to improve network performance:

- Whenever possible use the virtio network adapter. Otherwise, use one of the Intel PRO/1000 adapters.
- Use a Bridged attachment instead of NAT.
- Make sure segmentation offloading is enabled in the guest OS. Usually it will be enabled by default. You can check and modify offloading settings using the `ethtool` command on Linux guests.
- Perform a full detailed analysis of network traffic on the VM's network adaptor using a third party tool such as Wireshark. To do this, a promiscuous mode policy needs to be used on the VM's network adaptor. Use of this mode is only possible on the following network types: NAT Network, Bridged Adapter, Internal Network, and Host-Only Adapter.

  To setup a promiscuous mode policy, either select from the drop down list located in the **Network Settings** dialog for the network adaptor or use the command line tool `VBoxManage`. See VBoxManage modifyvm.

  Promiscuous mode policies are as follows:

  - `deny`, which hides any traffic not intended for the VM's network adaptor. This is the default setting.
  - `allow-vms`, which hides all host traffic from the VM's network adaptor, but allows it to see traffic from and to other VMs.
  - `allow-all`, which removes all restrictions. The VM's network adaptor sees all traffic.

7

Remote Virtual Machines

Remote Display (VRDP Support)

Oracle VM VirtualBox can display virtual machines remotely, meaning that a virtual machine can execute on one computer even though the machine will be displayed on a second computer, and the machine will be controlled from there as well, as if the virtual machine was running on that second computer.

For maximum flexibility, Oracle VM VirtualBox implements remote machine display through a generic extension interface called the VirtualBox Remote Desktop Extension (VRDE). The base open source Oracle VM VirtualBox package only provides this interface, while implementations can be supplied by third parties with Oracle VM VirtualBox extension packages, which must be installed separately from the base package. See Installing Oracle VM VirtualBox and Extension Packs.

Oracle provides support for the VirtualBox Remote Display Protocol (VRDP) in such an Oracle VM VirtualBox extension package.

VRDP is a backwards-compatible extension to Microsoft's Remote Desktop Protocol (RDP). As a result, you can use any standard RDP client to control the remote VM.

Even when the extension is installed, the VRDP server is disabled by default. It can easily be enabled on a per-VM basis either from VirtualBox Manager in the **Display** settings, see Display Settings, or with the `VBoxManage` command, as follows:

```
$ VBoxManage modifyvm VM-name --vrde on
```

By default, the VRDP server uses TCP port `3389`. You will need to change the default port if you run more than one VRDP server, since the port can only be used by one server at a time. You might also need to change it on Windows hosts since the default port might already be used by the RDP server that is built into Windows itself. Ports 5000 through 5050 are typically not used and might be a good choice.

The port can be changed either in the **Display** settings of the graphical user interface or with the `--vrde-port` option of the `VBoxManage modifyvm` command. You can specify a comma-separated list of ports or ranges of ports. Use a dash between two port numbers to specify a range. The VRDP server will bind to *one* of the available ports from the specified list. For example, `VBoxManage modifyvm VM-name --vrde-port 5000,5010-5012` configures the server to bind to one of the ports 5000, 5010, 5011, or 5012. See VBoxManage modifyvm.

The actual port used by a running VM can be either queried with the `VBoxManage showvminfo` command or seen in VirtualBox Manager on the **Runtime** tab of the **Session Information** dialog, which is accessible from the **Machine** menu of the VM window.

Oracle VM VirtualBox supports IPv6. If the host OS supports IPv6 the VRDP server will automatically listen for IPv6 connections in addition to IPv4.

Common Third-Party RDP Viewers

Since VRDP is backwards-compatible to RDP, you can use any standard RDP viewer to connect to such a remote virtual machine. For this to work, you must specify the IP address of your *host* system, not of the virtual machine, as the server address to connect to. You must also specify the port number that the VRDP server is using.

The following examples are for the most common RDP viewers:

- On Windows, you can use the Microsoft Terminal Services Connector, `mstsc.exe`, that is included with Windows. Press the Windows key + R, to display the **Run** dialog. Enter `mstsc` to start the program. You can also find the program in **Start**, **All Programs**, **Accessories**, **Remote Desktop Connection**. If you use the **Run** dialog, you can enter options directly. For example:

  ```
  mstsc 1.2.3.4:3389
  ```

  Replace `1.2.3.4` with the host IP address, and `3389` with a different port, if necessary.

  > **Note:**
  >
  > – IPv6 addresses must be enclosed in square brackets to specify a port. For example: `mstsc [fe80::1:2:3:4]:3389`
  >
  > – When connecting to localhost in order to test the connection, the addresses `localhost` and `127.0.0.1` might not work using `mstsc.exe`. Instead, the address `127.0.0.2[:3389]` has to be used.

- On other systems, you can use the standard open source `rdesktop` program. This ships with most Linux distributions.

  With `rdesktop`, use a command line such as the following:

  ```
  $ rdesktop -a 16 -N 1.2.3.4:3389
  ```

  Replace `1.2.3.4` with the host IP address, and `3389` with a different port, if necessary. The `-a` 16 option requests a color depth of 16 bits per pixel, which we recommend. For best performance, after installation of the guest operating system, you should set its display color depth to the same value. The `-N` option enables use of the NumPad keys.

- You can use the Remmina remote desktop client with VRDP. This application is included with some Linux distributions, such as Debian and Ubuntu.

- If you run the KDE desktop, you can use `krdc`, the KDE RDP viewer. A typical command line is as follows:

  ```
  $ krdc rdp://1.2.3.4:3389
  ```

  Replace `1.2.3.4` with the host IP address, and `3389` with a different port, if necessary. The `rdp://` prefix is required with `krdc` to switch it into RDP mode.

- With Sun Ray thin clients you can use `uttsc`, which is part of the Sun Ray Windows Connector package. See the Sun Ray documentation for details.

VBoxHeadless, the Remote Desktop Server

While any VM started from VirtualBox Manager is capable of running virtual machines remotely, it is not convenient to have to run the full GUI if you never want to have VMs displayed locally in the first place. In particular, if you are running server hardware whose only purpose is to host VMs, and all your VMs are supposed to run remotely over VRDP, then it is pointless to have a graphical user interface on the server at all. This is especially true for Linux or Oracle Solaris hosts, as the VirtualBox Manager comes with dependencies on the Qt and SDL libraries. This is inconvenient if you would rather not have the X Window system on your server at all.

Oracle VM VirtualBox therefore comes with a front-end called `VBoxHeadless`, which produces no visible output on the host at all, but still can optionally deliver VRDP data. This front-end has no dependencies on the X Window system on Linux and Oracle Solaris hosts.

> **Note:**
>
> In legacy releases of Oracle VM VirtualBox, the headless server was called `VBoxVRDP`. For backwards compatibility, the Oracle VM VirtualBox installation still includes an executable with that name.

To start a virtual machine with `VBoxHeadless`, you have the following options:

- Use the `VBoxManage` command, as follows:

  ```
  $ VBoxManage startvm VM-name --type headless
  ```

  The `--type` option causes Oracle VM VirtualBox to use `VBoxHeadless` as the front-end to the internal virtualization engine, instead of the Qt front-end.

- Use the `VBoxHeadless` command, as follows:

  ```
  VBoxHeadless --startvm uuid|vmname
  ```

  This way of starting the VM helps troubleshooting problems reported by `VBoxManage startvm`, because you can sometimes see more detailed error messages, especially for early failures before the VM execution is started. In normal situations `VBoxManage startvm` is preferred, since it runs the VM directly as a background process which has to be done explicitly when directly starting with `VBoxHeadless`.

- Start `VBoxHeadless` from VirtualBox Manager, by pressing the Shift key when starting a virtual machine or by selecting **Headless Start** from the **Machine** menu.

When you use the `VBoxHeadless` command to start a VM, the VRDP server will be enabled according to the VM configuration. You can override the VM's setting using `--vrde` command line parameter. To enable the VRDP server, start the VM as follows:

```
VBoxHeadless --startvm uuid|vmname --vrde on
```

To disable the VRDP server:

```
VBoxHeadless --startvm uuid|vmname --vrde off
```

To have the VRDP server enabled depending on the VM configuration, as for other front-ends:

```
VBoxHeadless --startvm uuid|vmname --vrde config
```

This command is the same as the following:

```
VBoxHeadless --startvm uuid|vmname
```

If you start the VM with `VBoxManage startvm` then the configuration settings of the VM are always used.

Step by Step: Creating a Virtual Machine on a Headless Server

The following instructions describe how to create a virtual machine on a headless server over a network connection. This example creates a virtual machine, establishes an RDP connection and installs a guest operating system. All of these tasks are done without having to touch the headless server. You need the following prerequisites:

- Oracle VM VirtualBox on a server machine with a supported host operating system. The Oracle VM VirtualBox Extension Pack for the VRDP server must be installed, see Remote Display (VRDP Support). The procedures assume a Linux server is used.
- An ISO file accessible from the server, containing the installation data for the guest operating system to install. Windows XP is used in the example.
- A terminal connection to that host through which you can access a command line, such as `ssh`.
- An RDP viewer on the remote client. See Common Third-Party RDP Viewers for examples.

Note that on the server machine, since we will only use the headless server, Qt and the X Window system are not required.

1. On the headless server, create a new virtual machine. For example:

   ```
   VBoxManage createvm --name "Windows XP" --ostype WindowsXP --register
   ```

   If you do not specify `--register`, you will have to manually use the `registervm` command later.

   You do not need to specify `--ostype`, but doing so selects some sensible default values for certain VM parameters. For example, the RAM size and the type of the virtual network device. To get a complete list of supported operating systems you can use the following command:

   ```
   VBoxManage list ostypes
   ```

2. Make sure the settings for the VM are appropriate for the guest operating system that we will install. For example:

   ```
   VBoxManage modifyvm "Windows XP" --memory 256 --acpi on --boot1 dvd --nic1 nat
   ```

3. Create a virtual hard disk for the VM. For example, to create a 10 GB virtual hard disk:

   ```
   VBoxManage createhd --filename "WinXP.vdi" --size 10000
   ```

4. Add an IDE Controller to the new VM. For example:

   ```
   VBoxManage storagectl "Windows XP" --name "IDE Controller"
     --add ide --controller PIIX4
   ```

5. Set the VDI file you created as the first virtual hard disk of the new VM. For example:

   ```
   VBoxManage storageattach "Windows XP" --storagectl "IDE Controller"
    --port 0 --device 0 --type hdd --medium "WinXP.vdi"
   ```

6. Attach the ISO file that contains the operating system installation that you want to install later to the virtual machine. This is done so that the VM can boot from it.

```
VBoxManage storageattach "Windows XP" --storagectl "IDE Controller"
 --port 0 --device 1 --type dvddrive --medium /full/path/to/iso.iso
```

7. Enable the VirtualBox Remote Desktop Extension, the VRDP server, as follows:

```
VBoxManage modifyvm "Windows XP" --vrde on
```

8. Start the virtual machine using the `VBoxHeadless` command:

```
VBoxHeadless --startvm "Windows XP"
```

   If the configuration steps worked, you should see a copyright notice. If you are returned to the command line, then something did not work correctly.

9. On the client machine, start the RDP viewer and connect to the server. See Common Third-Party RDP Viewers for details of how to use various common RDP viewers.

   The installation routine of your guest operating system should be displayed in the RDP viewer.

Remote USB

As a special feature additional to the VRDP support, Oracle VM VirtualBox also supports remote USB devices over the wire. That is, an Oracle VM VirtualBox guest that runs on one computer can access the USB devices of the remote computer on which the VRDP data is being displayed the same way as USB devices that are connected to the actual host. This enables running of virtual machines on an Oracle VM VirtualBox host that acts as a server, where a client can connect from elsewhere that needs only a network adapter and a display capable of running an RDP viewer. When USB devices are plugged into the client, the remote Oracle VM VirtualBox server can access them.

For these remote USB devices, the same filter rules apply as for other USB devices. See USB Settings. All you have to do is specify Remote, or Any, when setting up these rules.

Accessing remote USB devices is only possible if the RDP client supports this extension. Some versions of `uttsc`, a client tailored for the use with Sun Ray thin clients, support accessing remote USB devices. RDP clients for other platforms will be provided in future Oracle VM VirtualBox versions.

RDP Authentication

For each virtual machine that is remotely accessible using RDP, you can individually determine if and how client connections are authenticated. For this, use the `VBoxManage modifyvm` command with the `--vrde-auth-type` option. See VBoxManage modifyvm. The following methods of authentication are available:

- The **null** method means that there is no authentication at all. Any client can connect to the VRDP server and thus the virtual machine. This is very insecure and only to be recommended for private networks.
- The **external** method provides external authentication through a special authentication library. Oracle VM VirtualBox ships with two special authentication libraries:
  1. The default authentication library, `VBoxAuth`, authenticates against user credentials of the hosts. Depending on the host platform, this means the following:
     - On Linux hosts, `VBoxAuth.so` authenticates users against the host's PAM system.

- On Windows hosts, `VBoxAuth.dll` authenticates users against the host's WinLogon system.
- On macOS hosts, `VBoxAuth.dylib` authenticates users against the host's directory service.

In other words, the external method by default performs authentication with the user accounts that exist on the host system. Any user with valid authentication credentials is accepted. For example, the username does not have to correspond to the user running the VM.

2. An additional library called `VBoxAuthSimple` performs authentication against credentials configured in the `extradata` section of a virtual machine's XML settings file. This is probably the simplest way to get authentication that does not depend on a running and supported guest. The following steps are required:

   a. Enable `VBoxAuthSimple` with the following command:

   ```
   VBoxManage setproperty vrdeauthlibrary "VBoxAuthSimple"
   ```

   b. To enable the library for a particular VM, you must switch authentication to external, as follows:

   ```
   VBoxManage modifyvm VM-name --vrde-auth-type external
   ```

   Replace *VM-name* with the VM name or UUID.

   c. You then need to configure users and passwords by writing items into the machine's extradata. Since the XML machine settings file, into whose `extradata` section the password needs to be written, is a plain text file, Oracle VM VirtualBox uses hashes to encrypt passwords. The following command must be used:

   ```
   VBoxManage setextradata VM-name "VBoxAuthSimple/users/user" hash
   ```

   Replace *VM-name* with the VM name or UUID, *user* with the user name who should be allowed to log in and *hash* with the encrypted password. The following command example obtains the hash value for the password `secret`:

   ```
   $ VBoxManage internalcommands passwordhash "secret"
   2bb80d537b1da3e38bd30361aa855686bde0eacd7162fef6a25fe97bf527a25b
   ```

   You then use `VBoxManage setextradata` to store this value in the machine's `extradata` section.

   As a combined example, to set the password for the user `john` and the machine `My VM` to `secret`, use this command:

   ```
   VBoxManage setextradata "My VM" "VBoxAuthSimple/users/john"
       2bb80d537b1da3e38bd30361aa855686bde0eacd7162fef6a25fe97bf527a25b
   ```

- The **guest** authentication method performs authentication with a special component that comes with the Guest Additions. As a result, authentication is not performed on the host, but with the guest user accounts.

  This method is currently still in testing and not yet supported.

In addition to the methods described above, you can replace the default external authentication module with any other module. For this, Oracle VM VirtualBox provides a well-defined interface that enables you to write your own authentication module. This is described in detail in the Oracle VM VirtualBox Software Development Kit (SDK) reference. See Oracle VM VirtualBox Programming Interfaces.

RDP Encryption

RDP features data stream encryption, which is based on the RC4 symmetric cipher, with keys up to 128-bit. The RC4 keys are replaced at regular intervals, every 4096 packets.

RDP provides the following different authentication methods:

- **RDP 4** authentication was used historically. With RDP 4, the RDP client does not perform any checks in order to verify the identity of the server it connects to. Since user credentials can be obtained using a man in the middle (MITM) attack, RDP4 authentication is insecure and should generally not be used.
- **RDP 5.1** authentication employs a server certificate for which the client possesses the public key. This way it is guaranteed that the server possess the corresponding private key. However, as this hard-coded private key became public some years ago, RDP 5.1 authentication is also insecure.
- **RDP 5.2 or later** authentication uses Enhanced RDP Security, which means that an external security protocol is used to secure the connection. RDP 4 and RDP 5.1 use Standard RDP Security. The VRDP server supports Enhanced RDP Security with TLS protocol and, as a part of the TLS handshake, sends the server certificate to the client.

  The `Security/Method` VRDE property sets the desired security method, which is used for a connection. Valid values are as follows:

  - **Negotiate.** Both Enhanced (TLS) and Standard RDP Security connections are allowed. The security method is negotiated with the client. This is the default setting.
  - **RDP.** Only Standard RDP Security is accepted.
  - **TLS.** Only Enhanced RDP Security is accepted. The client must support TLS.

    The version of OpenSSL used by Oracle VM VirtualBox supports TLS versions 1.0, 1.1, 1.2, and 1.3.

  For example, the following command enables a client to use either Standard or Enhanced RDP Security connection:

  ```
  vboxmanage modifyvm VM-name --vrde-property "Security/Method=negotiate"
  ```

  If the `Security/Method` property is set to either Negotiate or TLS, the TLS protocol will be automatically used by the server, if the client supports TLS. However, in order to use TLS the server must possess the Server Certificate, the Server Private Key and the Certificate Authority (CA) Certificate. The following example shows how to generate a server certificate.

  1. Create a CA self signed certificate.

     ```
     openssl req -new -x509 -days 365 -extensions v3_ca \
       -keyout ca_key_private.pem -out ca_cert.pem
     ```

  2. Generate a server private key and a request for signing.

     ```
     openssl genrsa -out server_key_private.pem
     openssl req -new -key server_key_private.pem -out server_req.pem
     ```

  3. Generate the server certificate.

     ```
     openssl x509 -req -days 365 -in server_req.pem \
       -CA ca_cert.pem -CAkey ca_key_private.pem -set_serial 01 -out server_cert.pem
     ```

  The server must be configured to access the required files. For example:

```
vboxmanage modifyvm VM-name \
  --vrde-property "Security/CACertificate=path/ca_cert.pem"

vboxmanage modifyvm VM-name \
  --vrde-property "Security/ServerCertificate=path/server_cert.pem"

vboxmanage modifyvm VM-name \
  --vrde-property "Security/ServerPrivateKey=path/server_key_private.pem"
```

As the client that connects to the server determines what type of encryption will be used, with `rdesktop`, the Linux RDP viewer, use the `-4` or `-5` options.

Multiple Connections to the VRDP Server

The VRDP server of Oracle VM VirtualBox supports multiple simultaneous connections to the same running VM from different clients. All connected clients see the same screen output and share a mouse pointer and keyboard focus. This is similar to several people using the same computer at the same time, taking turns at the keyboard.

The following command enables multiple connection mode:

```
VBoxManage modifyvm VM-name --vrde-multi-con on
```

Multiple Remote Monitors

To access two or more remote VM displays you have to enable the VRDP multiconnection mode. See Multiple Connections to the VRDP Server.

The RDP client can select the virtual monitor number to connect to using the `domain` login parameter (`-d`). If the parameter ends with `@` followed by a number, Oracle VM VirtualBox interprets this number as the screen index. The primary guest screen is selected with `@1`, the first secondary screen is `@2`, and so on.

The Microsoft RDP 6 client does not let you specify a separate domain name. Instead, enter *`domain\username`* in the **Username** field. For example, `@2\`*`name`* . *name* must be supplied, and must be the name used to log in if the VRDP server is set up to require credentials. If it is not, you may use any text as the username.

VRDP Video Redirection

The VRDP server can redirect video streams from the guest to the RDP client. Video frames are compressed using the JPEG algorithm allowing a higher compression ratio than standard RDP bitmap compression methods. It is possible to increase the compression ratio by lowering the video quality.

The VRDP server automatically detects video streams in a guest as frequently updated rectangular areas. As a result, this method works with any guest operating system without having to install additional software in the guest. In particular, the Guest Additions are not required.

On the client side, however, currently only the Windows 7 Remote Desktop Connection client supports this feature. If a client does not support video redirection, the VRDP server falls back to regular bitmap updates.

The following command enables video redirection:

```
VBoxManage modifyvm VM-name --vrde-video-channel on
```

The quality of the video is defined as a value from 10 to 100 percent, representing a JPEG compression level, where lower numbers mean lower quality but higher compression. The quality can be changed using the following command:

```
VBoxManage modifyvm VM-name --vrde-video-channel-quality 75
```

VRDP Customization

You can disable display output, mouse and keyboard input, audio, remote USB, or clipboard individually in the VRDP server.

The following commands change the corresponding server settings:

```
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableDisplay=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableInput=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableUSB=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableAudio=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableClipboard=1
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableUpstreamAudio=1
```

To reenable a feature, use a similar command without the trailing 1. For example:

```
$ VBoxManage modifyvm VM-name --vrde-property Client/DisableDisplay=
```

Teleporting

Oracle VM VirtualBox supports *teleporting*. Teleporting is moving a virtual machine over a network from one Oracle VM VirtualBox host to another, while the virtual machine is running. This works regardless of the host operating system that is running on the hosts. You can teleport virtual machines between Oracle Solaris and macOS hosts, for example.

Teleporting requires that a machine be currently running on one host, which is called the *source*. The host to which the virtual machine will be teleported is called the *target*. The machine on the target is then configured to wait for the source to contact the target. The machine's running state will then be transferred from the source to the target with minimal downtime.

Teleporting happens over any TCP/IP network. The source and the target only need to agree on a TCP/IP port which is specified in the teleporting settings.

At this time, there are a few prerequisites for this to work, as follows:

- On the target host, you must configure a virtual machine in Oracle VM VirtualBox with exactly the same hardware settings as the machine on the source that you want to teleport. This does not apply to settings which are merely descriptive, such as the VM name, but obviously for teleporting to work, the target machine must have the same amount of memory and other hardware settings. Otherwise teleporting will fail with an error message.
- The two virtual machines on the source and the target must share the same storage, hard disks as well as floppy disks and CD/DVD images. This means that they either use the same iSCSI targets or that the storage resides somewhere on the network and both hosts have access to it using NFS or SMB/CIFS.

  This also means that neither the source nor the target machine can have any snapshots.

To configure teleporting, perform the following steps:

1. On the *target* host, configure the virtual machine to wait for a teleport request to arrive when it is started, instead of actually attempting to start the machine. This is done with the following `VBoxManage` command:

   ```
   VBoxManage modifyvm targetvmname --teleporter on --teleporter-port port
   ```

   targetvmname is the name of the virtual machine on the target host and *port* is a TCP/IP port number to be used on both the source and the target hosts. For example, use 6000. See VBoxManage modifyvm.

2. Start the VM on the target host. Instead of running, the VM shows a progress dialog, indicating that it is waiting for a teleport request to arrive.

3. Start the VM on the *source* host as usual. When it is running and you want it to be teleported, issue the following command on the source host:

   ```
   VBoxManage controlvm sourcevmname teleport --host targethost --port port
   ```

   where *sourcevmname* is the name of the virtual machine on the source host, which is the machine that is currently running. *targethost* is the host or IP name of the target host on which the machine is waiting for the teleport request, and *port* must be the same number as specified in the command on the target host. See VBoxManage controlvm.

For testing, you can also teleport machines on the same host. In that case, use localhost as the hostname on both the source and the target host.

> **Note:**
>
> In rare cases, if the CPUs of the source and the target are very different, teleporting can fail with an error message, or the target may hang. This may happen especially if the VM is running application software that is highly optimized to run on a particular CPU without correctly checking that certain CPU features are actually present. Oracle VM VirtualBox filters what CPU capabilities are presented to the guest operating system. Advanced users can attempt to restrict these virtual CPU capabilities with the `VBoxManage modifyvm --cpuid-portability-level` command. See VBoxManage modifyvm.

VBoxHeadless

Oracle VM VirtualBox remote desktop server

Synopsis

```
VBoxHeadless [--startvm=<uuid | vmname>] [--vrde=on | off | config]
[--vrdeproperty=prop-name= [prop-value]] [--settingspw=password]
[--settingspwfile=password-file] [--start-paused] [--capture] [--width=width]
[--height=height] [--bitrate=bit-rate] [--filename=filename]
```

Description

The `VBoxHeadless` command is an alternate front end that enables you to remotely manage virtual machines (VMs). The front end is a CLI rather than the VirtualBox Manager graphical user interface (GUI).

For information about using this command, see VBoxHeadless, the Remote Desktop Server.

Command Options

`--startvm=`*`uuid`*` | `*`vmname`
Specifies the Universally Unique Identifier (UUID) or name of the VM to start.
Use the `VBoxManage list vms` command to obtain VM information.
The short versions of this option is `-s`.

`--vrde=on | off | config`
Specifies how to use the VRDP server. The default value is `config`. Valid values are as follows:

- `on` enables the VRDP server.

  ```
  VBoxHeadless --startvm=vmname --vrde=on
  ```

- `off` disables the VRDP server.

  ```
  VBoxHeadless --startvm=vmname --vrde=off
  ```

- `config` enables the VRDP server depending on the VM configuration.

  ```
  VBoxHeadless --startvm=vmname --vrde=config
  ```

The short version of this option is `-v`.

`--vrdeproperty=`*`prop-name`*`=[`*`prop-value`*`]`
Specifies a value for one of the following properties:

- The `TCP/Ports` property value is a comma-separated list of ports to which the VRDE server can bind. Use a hyphen (-) between two port numbers to specify a range of ports.
- The `TCP/Address` property value is the interface IP address to which to bind the VRDE server.

`--settingspw=`*`password`*
Specifies a settings password to access encrypted settings. If you do not specify the password on the command line, `VBoxHeadless` prompts you for the password.

`--settingspwfile=`*`password-file`*
Specifies the file that contains the settings password.

`--start-paused`
Starts the specified VM in the paused state.

`--capture`
Records the VM screen output to a file. In addition to this option, you must use the `--filename` option to specify the name of the file.

`--width=` *width*
Specifies the frame width of the recording in pixels. This option is associated with the `--capture` option.

`--height=` *height*
Specifies the frame height of the recording in pixels. This option is associated with the `--capture` option.

`--bitrate=` *bit-rate*
Specifies the bit rate of the recording in kilobits per second. This option is associated with the `--capture` option.

`--filename=` *filename*
Specifies the name of the file in which to store the recording. The codec used is based on the file extension that you choose. You must specify this option if you use the `--capture` option.

Examples

The following command starts the `ol7u4` VM:

```
$ VBoxHeadless --startvm "ol7u4"
```

The following command starts the `ol7u6` VM in the Paused state.

```
$ VBoxHeadless --startvm "ol7u6" --start-paused
```

The following command starts the `ol7u6` VM and records the session. The recording is saved to the `ol7u6-recording` WebM file.

```
$ VBoxHeadless --startvm "ol7u6" --capture --filename ol7u6-recording.webm
```

See Also

VBoxManage list, VBoxManage startvm

8 VBoxManage

Introduction

As briefly mentioned in Alternative Front-Ends, `VBoxManage` is the command-line interface to Oracle VM VirtualBox. With it, you can completely control Oracle VM VirtualBox from the command line of your host operating system. `VBoxManage` supports all the features that the graphical user interface gives you access to, but it supports a lot more than that. It exposes all the features of the virtualization engine, even those that cannot be accessed from the GUI.

You will need to use the command line if you want to do the following:

- Use a different user interface than the main GUI such as the VBoxHeadless server.
- Control some of the more advanced and experimental configuration settings for a VM.

There are two main things to keep in mind when using `VBoxManage`. First, `VBoxManage` must always be used with a specific subcommand, such as `list` or `createvm` or `startvm`. All the subcommands that `VBoxManage` supports are described in detail in VBoxManage.

Second, most of these subcommands require that you specify a particular virtual machine after the subcommand. There are two ways you can do this:

- You can specify the VM name, as it is shown in the Oracle VM VirtualBox GUI. Note that if that name contains spaces, then you must enclose the entire name in double quotes. This is always required with command line arguments that contain spaces. For example:

  ```
  VBoxManage startvm "Windows XP"
  ```

- You can specify the UUID, which is the internal unique identifier that Oracle VM VirtualBox uses to refer to the virtual machine. Assuming that the VM called "Windows XP" has the UUID shown below, the following command has the same effect as the previous example:

  ```
  VBoxManage startvm 670e746d-abea-4ba6-ad02-2a3b043810a5
  ```

You can enter `VBoxManage list vms` to have all currently registered VMs listed with all their settings, including their respective names and UUIDs.

Some typical examples of how to control Oracle VM VirtualBox from the command line are listed below:

- To create a new virtual machine from the command line and immediately register it with Oracle VM VirtualBox, use `VBoxManage createvm` with the --register option, as follows:

  ```
  $ VBoxManage createvm --name "SUSE 10.2" --register
  VirtualBox Command Line Management Interface Version version-number
  (C) 2005-2018 Oracle Corporation
  All rights reserved.

  Virtual machine 'SUSE 10.2' is created.
  UUID: c89fc351-8ec6-4f02-a048-57f4d25288e5
  Settings file: '/home/username/.config/VirtualBox/Machines/SUSE 10.2/SUSE 10.2.xml'
  ```

  As can be seen from the above output, a new virtual machine has been created with a new UUID and a new XML settings file.

For more details, see VBoxManage createvm.

- To show the configuration of a particular VM, use `VBoxManage showvminfo`. See VBoxManage showvminfo for details and an example.
- To change settings while a VM is powered off, use `VBoxManage modifyvm`. For example:

```
VBoxManage modifyvm "Windows XP" --memory 512
```

  See also VBoxManage modifyvm.
- To change the storage configuration, such as to add a storage controller and then a virtual disk, use `VBoxManage storagectl` and `VBoxManage storageattach`. See VBoxManage storagectl and VBoxManage storageattach.
- To control VM operation, use one of the following:
  - To start a VM that is currently powered off, use `VBoxManage startvm`. See VBoxManage startvm.
  - To pause or save a VM that is currently running or change some of its settings, use `VBoxManage controlvm`. See VBoxManage controlvm.

Commands Overview

When running `VBoxManage` without parameters or when supplying an invalid command line, the following command syntax list is shown. Note that the output will be slightly different depending on the host platform. If in doubt, check the output of `VBoxManage` for the commands available on your particular host.

```
VBoxManage [-q | --nologo] [--settingspw=password]
[--settingspwfile=pw-file] [@response-file] [subcommand]
```

```
VBoxManage help [subcommand]
```

```
VBoxManage commands
```

```
VBoxManage [-V | --version]
```

```
VBoxManage [--dump-build-type]
```

```
VBoxManage adoptstate <uuid | vmname> <state-filename>
```

```
VBoxManage bandwidthctl <uuid | vmname> add <bandwidth-group-name>
<--limit=bandwidth-limit[k|m|g|K|M|G]> <--type=disk | network>
```

```
VBoxManage bandwidthctl <uuid | vmname> list [--machinereadable]
```

```
VBoxManage bandwidthctl <uuid | vmname> remove <bandwidth-group-name>
```

```
VBoxManage bandwidthctl <uuid | vmname> set <bandwidth-group-name>
<--limit=bandwidth-limit[k|m|g|K|M|G]>
```

```
VBoxManage checkmediumpwd <uuid | filename> <password-file>
```

```
VBoxManage clonemedium <uuid | source-medium> <uuid | target-medium> [disk |
dvd | floppy] [--existing] [--format=VDI | VMDK | VHD | RAW | other]
[--variant=Standard|Fixed|Split2G|Stream|ESX...]
```

```
VBoxManage clonevm <vmname|uuid> [--basefolder=basefolder]
[--groups=group,...] [--mode=machine | --mode=machinechildren |
--mode=all] [--name=name] [--options=option,...] [--register]
[--snapshot=snapshot-name] [--uuid=uuid]
```

```
VBoxManage closemedium [disk | dvd | floppy] <uuid | filename> [--delete]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
list instances [--state=string] [--compartment-id=string]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
list images <--compartment-id=string> [--state=string]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
list vnicattachments <--compartment-id=string> [--filter=instanceId |
vnicId | availabilityDomain=value...]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance create <--domain-name=name> <--image-id=id | --boot-volume-id=id>
<--display-name=name> <--shape=type> <--subnet=id> [--boot-disk-size=size in
GB] [--publicip=true | false] [--privateip=IP address]
[--public-ssh-key=key string...] [--launch-mode=NATIVE | EMULATED |
PARAVIRTUALIZED] [--cloud-init-script-path=path to a script]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance info <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance terminate <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance start <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance pause <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
```

```
instance reset <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image create <--display-name=name> [--bucket-name=name]
[--object-name=name] [--instance-id=unique id]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image info <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image delete <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image import <--id=unique id> [--bucket-name=name] [--object-name=name]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image export <--id=unique id> <--display-name=name> [--bucket-name=name]
[--object-name=name]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
network setup [--gateway-os-name=string] [--gateway-os-version=string]
[--gateway-shape=string] [--tunnel-network-name=string]
[--tunnel-network-range=string] [--proxy=string] [--compartment-id=string]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
network create <--name=string> <--network-id=string> [--enable | --disable]
```

```
VBoxManage cloud network update <--name=string> [--network-id=string]
[--enable | --disable]
```

```
VBoxManage cloud network delete <--name=string>
```

```
VBoxManage cloud >network info <--name=string>
```

```
VBoxManage cloudprofile <--provider=name> <--profile=name> add
[--clouduser=unique id] [--fingerprint=MD5 string] [--keyfile=path]
[--passphrase=string] [--tenancy=unique id] [--compartment=unique id]
[--region=string]
```

```
VBoxManage cloudprofile <--provider=name> <--profile=name> update
[--clouduser=unique id] [--fingerprint=MD5 string] [--keyfile=path]
[--passphrase=string] [--tenancy=unique id] [--compartment=unique id]
[--region=string]
```

```
VBoxManage cloudprofile <--provider=name> <--profile=name> delete
```

```
VBoxManage cloudprofile <--provider=name> <--profile=name> show
```

```
VBoxManage controlvm <uuid | vmname> pause
```

```
VBoxManage controlvm <uuid | vmname> resume
```

```
VBoxManage controlvm <uuid | vmname> reset
```

```
VBoxManage controlvm <uuid | vmname> poweroff
```

```
VBoxManage controlvm <uuid | vmname> savestate
```

```
VBoxManage controlvm <uuid | vmname> acpipowerbutton
```

```
VBoxManage controlvm <uuid | vmname> acpisleepbutton
```

```
VBoxManage controlvm <uuid | vmname> reboot
```

```
VBoxManage controlvm <uuid | vmname> shutdown [--force]
```

```
VBoxManage controlvm <uuid | vmname> keyboardputscancode <hex> [hex...]
```

```
VBoxManage controlvm <uuid | vmname> keyboardputstring <string>
[string...]
```

```
VBoxManage controlvm <uuid | vmname> keyboardputfile <filename>
```

```
VBoxManage controlvm <uuid | vmname> setlinkstateN <on | off>
```

```
VBoxManage controlvm <uuid | vmname> nicN <null | nat | bridged |
intnet | hostonly | generic | natnetwork> [device-name]
```

```
VBoxManage controlvm <uuid | vmname> nictraceN <on | off>
```

```
VBoxManage controlvm <uuid | vmname> nictracefileN <filename>
```

```
VBoxManage controlvm <uuid | vmname> nicpropertyN <prop-name=prop-value>
```

```
VBoxManage controlvm <uuid | vmname> nicpromiscN <deny | allow-vms |
allow-all>
```

```
VBoxManage controlvm <uuid | vmname> natpfN <[rulename],<tcp|udp>,
[host-IP],hostport,[guest-IP],guestport>
```

```
VBoxManage controlvm <uuid | vmname> natpfNdelete <rulename>
```

```
VBoxManage controlvm <uuid | vmname> guestmemoryballoon <balloon-size>
```

```
VBoxManage controlvm <uuid | vmname> usbattach <uuid | address>
[--capturefile=filename]
```

```
VBoxManage controlvm <uuid | vmname> usbdetach <uuid | address>
```

```
VBoxManage controlvm <uuid | vmname> audioin <on | off>
```

```
VBoxManage controlvm <uuid | vmname> audioout <on | off>
```

```
VBoxManage controlvm <uuid | vmname> clipboard mode <disabled |
hosttoguest | guesttohost | bidirectional>
```

```
VBoxManage controlvm <uuid | vmname> clipboard filetransfers <on | off>
```

```
VBoxManage controlvm <uuid | vmname> draganddrop <disabled |
hosttoguest | guesttohost | bidirectional>
```

```
VBoxManage controlvm <uuid | vmname> vrde <on | off>
```

```
VBoxManage controlvm <uuid | vmname> vrdeport <port>
```

```
VBoxManage controlvm <uuid | vmname> vrdeproperty <prop-name=prop-value>
```

```
VBoxManage controlvm <uuid | vmname> vrdevideochannelquality
<percentage>
```

```
VBoxManage controlvm <uuid | vmname> setvideomodehint <xres> <yres> <bpp>
[display [ <yes | no> [ x-origin y-origin]]]
```

```
VBoxManage controlvm <uuid | vmname> setscreenlayout <display> <on |
primary x-origin y-origin x-resolution y-resolution bpp | off>
```

```
VBoxManage controlvm <uuid | vmname> screenshotpng <filename> [display]
```

```
VBoxManage controlvm <uuid | vmname> recording <on | off>
```

```
VBoxManage controlvm <uuid | vmname> recording screens <all | none |
screen-ID ,screen-ID...>
```

```
VBoxManage controlvm <uuid | vmname> recording filename <filename>
```

```
VBoxManage controlvm <uuid | vmname> recording videores <<width>x
<height>>
```

```
VBoxManage controlvm <uuid | vmname> recording videorate <rate>
```

```
VBoxManage controlvm <uuid | vmname> recording videofps <fps>
```

```
VBoxManage controlvm <uuid | vmname> recording maxtime <sec>
```

```
VBoxManage controlvm <uuid | vmname> recording maxfilesize <MB>
```

```
VBoxManage controlvm <uuid | vmname> setcredentials <username>
--passwordfile=<filename | password> <domain-name> --allowlocallogon=<yes |
no>
```

```
VBoxManage controlvm <uuid | vmname> teleport <--host=host-name>
<--port=port-name> [--maxdowntime=msec] [--passwordfile=filename |
--password=password]
```

```
VBoxManage controlvm <uuid | vmname> plugcpu <ID>
```

```
VBoxManage controlvm <uuid | vmname> unplugcpu <ID>
```

```
VBoxManage controlvm <uuid | vmname> cpuexecutioncap <num>
```

```
VBoxManage controlvm <uuid | vmname> vm-process-priority <default |
flat | low | normal | high>
```

```
VBoxManage controlvm <uuid | vmname> webcam attach [pathname [settings]]
```

```
VBoxManage controlvm <uuid | vmname> webcam detach [pathname]
```

```
VBoxManage controlvm <uuid | vmname> webcam list
```

```
VBoxManage controlvm <uuid | vmname> addencpassword <ID> <password-file |
-> [--removeonsuspend=yes | no]
```

```
VBoxManage controlvm <uuid | vmname> removeencpassword <ID>
```

```
VBoxManage controlvm <uuid | vmname> removeallencpasswords
```

```
VBoxManage controlvm <uuid | vmname> changeuartmodeN disconnected |
server pipe-name | client pipe-name | tcpserver port | tcpclient
hostname:port | file filename | device-name
```

```
VBoxManage controlvm <uuid | vmname> autostart-enabledN on | off
```

```
VBoxManage controlvm <uuid | vmname> autostart-delay <seconds>
```

```
VBoxManage convertfromraw <inputfile> <outputfile> [--format=VDI | VMDK |
VHD] [--uuid=uuid] [--variant=Standard|Fixed|Split2G|Stream|ESX...]
```

```
VBoxManage convertfromraw stdin <outputfile> <bytes> [--format=VDI | VMDK |
VHD] [--uuid=uuid] [--variant=Standard|Fixed|Split2G|Stream|ESX...]
```

```
VBoxManage createmedium [disk | dvd | floppy] <--filename=filename>
[--size=megabytes | --sizebyte=bytes] [--diffparent=UUID | filename]
[--format=VDI | VMDK | VHD] [--variant=Standard|Fixed|Split2G|Stream|
ESX|Formatted|RawDisk...] [--property=name=value...]
[--property-file=name=/path/to/file/with/value...]
```

```
VBoxManage createvm <--name=name> [--basefolder=basefolder] [--default]
[--group=group-ID [,...]] [--ostype=ostype] [--register] [--uuid=uuid]
[--cipher=cipher] [--password-id=password-id] [--password=file]
```

```
VBoxManage debugvm <uuid | vmname> dumpvmcore [--filename=name]
```

```
VBoxManage debugvm <uuid | vmname> info <item> [args...]
```

```
VBoxManage debugvm <uuid | vmname> injectnmi
```

```
VBoxManage debugvm <uuid | vmname> log [--release | --debug]
[group-settings...]
```

```
VBoxManage debugvm <uuid | vmname> logdest [--release | --debug]
[destinations...]
```

```
VBoxManage debugvm <uuid | vmname> logflags [--release | --debug]
[flags...]
```

```
VBoxManage debugvm <uuid | vmname> osdetect
```

```
VBoxManage debugvm <uuid | vmname> osinfo
```

```
VBoxManage debugvm <uuid | vmname> osdmesg [--lines=lines]
```

```
VBoxManage debugvm <uuid | vmname> getregisters [--cpu=id]
[reg-set.reg-name...]
```

```
VBoxManage debugvm <uuid | vmname> setregisters [--cpu=id]
[reg-set.reg-name=value...]
```

```
VBoxManage debugvm <uuid | vmname> show [--human-readable | --sh-export |
--sh-eval | --cmd-set] [settings-item...]
```

```
VBoxManage debugvm <uuid | vmname> stack [--cpu=id]
```

```
VBoxManage debugvm <uuid | vmname> statistics [--reset] [--descriptions]
[--pattern=pattern]
```

```
VBoxManage debugvm <uuid | vmname> guestsample [--filename=filename]
[--sample-interval-us=interval] [--sample-time-us=time]
```

```
VBoxManage dhcpserver add <--network=netname | --interface=ifname>
<--server-ip=address> <--netmask=mask> <--lower-ip=address>
<--upper-ip=address> <--enable | --disable>
[ [--global] [--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no
hexstring...] [--force-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--min-lease-time=seconds] [--default-lease-time=seconds]
[--max-lease-time=seconds]...]
[ <--group=name> [--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no
hexstring...] [--force-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--incl-mac=address...] [--excl-mac=address...] [--incl-mac-wild=pattern...]
[--excl-mac-wild=pattern...] [--incl-vendor=string...]
[--excl-vendor=string...] [--incl-vendor-wild=pattern...]
[--excl-vendor-wild=pattern...] [--incl-user=string...] [--excl-user=string...]
[--incl-user-wild=pattern...] [--excl-user-wild=pattern...]
[--min-lease-time=seconds] [--default-lease-time=seconds]
[--max-lease-time=seconds]...]
[ <--vm=name|uuid> [--nic=1-N] [--set-opt=dhcp-opt-no value...]
[--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--fixed-address=address]...]
[ <--mac-address=address> [--set-opt=dhcp-opt-no value...]
[--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--fixed-address=address]...]
```

```
VBoxManage dhcpserver modify <--network=netname | --interface=ifname>
[--server-ip=address] [--lower-ip=address] [--upper-ip=address]
[--netmask=mask] [--enable | --disable]
[ [--global] [--del-opt=dhcp-opt-no...] [--set-opt=dhcp-opt-no value...]
[--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--unforce-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
```

```
[--unsupress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--remove-config]...]
[ <--group=name> [--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no
hexstring...] [--force-opt=dhcp-opt-no...] [--unforce-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--unsupress-opt=dhcp-opt-no...]
[--del-mac=address...] [--incl-mac=address...] [--excl-mac=address...]
[--del-mac-wild=pattern...] [--incl-mac-wild=pattern...]
[--excl-mac-wild=pattern...] [--del-vendor=string...] [--incl-vendor=string...]
[--excl-vendor=string...] [--del-vendor-wild=pattern...]
[--incl-vendor-wild=pattern...] [--excl-vendor-wild=pattern...]
[--del-user=string...] [--incl-user=string...] [--excl-user=string...]
[--del-user-wild=pattern...] [--incl-user-wild=pattern...]
[--excl-user-wild=pattern...] [--zap-conditions] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--remove-config]...]
[ <--vm=name|uuid> [--nic=1-N] [--del-opt=dhcp-opt-no...]
[--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no hexstring...]
[--force-opt=dhcp-opt-no...] [--unforce-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--unsupress-opt=dhcp-opt-no...]
[--min-lease-time=seconds] [--default-lease-time=seconds]
[--max-lease-time=seconds] [--fixed-address=address] [--remove-config]...]
[ <--mac-address=address> [--del-opt=dhcp-opt-no...] [--set-opt=dhcp-opt-no
value...] [--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--unforce-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--unsupress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--fixed-address=address] [--remove-config]...]
```

```
VBoxManage dhcpserver remove <--network=netname | --interface=ifname>
```

```
VBoxManage dhcpserver start <--network=netname | --interface=ifname>
```

```
VBoxManage dhcpserver restart <--network=netname | --interface=ifname>
```

```
VBoxManage dhcpserver stop <--network=netname | --interface=ifname>
```

```
VBoxManage dhcpserver findlease <--network=netname | --interface=ifname>
<--mac-address=mac>
```

```
VBoxManage discardstate <uuid | vmname>
```

```
VBoxManage encryptmedium <uuid | filename> [--cipher=cipher-ID]
[--newpassword=password] [--newpasswordid=password-ID]
[--oldpassword=password]
```

```
VBoxManage encryptvm <uuid | vmname> setencryption --old-passwordfile
--cipher=cipher-identifier --new-passwordfile --new-password-id=password-identifier
--force
```

```
VBoxManage encryptvm <uuid | vmname> checkpassword <file>
```

```
VBoxManage encryptvm <uuid | vmname> addpassword --passwordfile
--password-id=password-identifier
```

```
VBoxManage encryptvm <uuid | vmname> removepassword <password-identifier>
```

```
VBoxManage export <machines> <--output=name> [--legacy09 | --ovf09 |
--ovf10 | --ovf20] [--manifest] [--options=manifest | iso | nomacs |
nomacsbutnat...] [--vsys=virtual-system-number] [--description=description-info]
[--eula=license-text] [--eulafile=filename] [--product=product-name]
[--producturl=product-URL] [--vendor=vendor-name] [--vendorurl=vendor-URL]
[--version=version-info] [--vmname=vmname]
```

```
VBoxManage export <machine> <--output=cloud-service-provider> [--opc10]
[--vmname=vmname] [--cloud=virtual-system-number]
[--cloudprofile=cloud-profile-name] [--cloudshape=cloud-shape-name]
[--clouddomain=cloud-domain] [--clouddisksize=disk-size-in-GB]
[--cloudbucket=bucket-name] [--cloudocivcn=OCI-VCN-ID]
```

```
[--cloudocisubnet=OCI-subnet-ID] [--cloudkeepobject=true | false]
[--cloudlaunchinstance=true | false] [--cloudlaunchmode=EMULATED |
PARAVIRTUALIZED] [--cloudpublicip=true | false]
```

```
VBoxManage extpack install [--replace] [--accept-license=sha256] <tarball>
```

```
VBoxManage extpack uninstall [--force] <name>
```

```
VBoxManage extpack cleanup
```

```
VBoxManage getextradata <global | uuid | vmname> <keyword | enumerate>
```

```
VBoxManage guestcontrol <uuid | vmname> run [--arg0=argument 0]
[--domain=domainname] [--dos2unix] [--exe=filename]
[--ignore-orphaned-processes] [--no-wait-stderr | --wait-stderr]
[--no-wait-stdout | --wait-stdout] [--passwordfile=password-file |
--password=password] [--profile] [--putenv=var-name=[value]] [--quiet]
[--timeout=msec] [--unix2dos] [--unquoted-args] [--username=username]
[--cwd=directory] [--verbose] <--[argument...]>
```

```
VBoxManage guestcontrol <uuid | vmname> start [--arg0=argument 0]
[--domain=domainname] [--exe=filename] [--ignore-orphaned-processes]
[--passwordfile=password-file | --password=password] [--profile]
[--putenv=var-name=[value]] [--quiet] [--timeout=msec] [--unquoted-args]
[--username=username] [--cwd=directory] [--verbose] <--[argument...]>
```

```
VBoxManage guestcontrol <uuid | vmname> copyfrom [--dereference]
[--domain=domainname] [--passwordfile=password-file | --password=password]
[--quiet] [--no-replace] [--recursive]
[--target-directory=host-destination-dir] [--update] [--username=username]
[--verbose] <guest-source0> guest-source1[...] <host-destination>
```

```
VBoxManage guestcontrol <uuid | vmname> copyto [--dereference]
[--domain=domainname] [--passwordfile=password-file | --password=password]
[--quiet] [--no-replace] [--recursive]
[--target-directory=guest-destination-dir] [--update] [--username=username]
[--verbose] <host-source0> host-source1[...]
```

```
VBoxManage guestcontrol <uuid | vmname> mkdir [--domain=domainname]
[--mode=mode] [--parents] [--passwordfile=password-file |
--password=password] [--quiet] [--username=username] [--verbose]
<guest-directory...>
```

```
VBoxManage guestcontrol <uuid | vmname> rmdir [--domain=domainname]
[--passwordfile=password-file | --password=password] [--quiet] [--recursive]
[--username=username] [--verbose] <guest-directory...>
```

```
VBoxManage guestcontrol <uuid | vmname> rm [--domain=domainname]
[--force] [--passwordfile=password-file | --password=password] [--quiet]
[--username=username] [--verbose] <guest-directory...>
```

```
VBoxManage guestcontrol <uuid | vmname> mv [--domain=domainname]
[--passwordfile=password-file | --password=password] [--quiet]
[--username=username] [--verbose] <source...> <destination-directory>
```

```
VBoxManage guestcontrol <uuid | vmname> mktemp [--directory]
[--domain=domainname] [--mode=mode] [--passwordfile=password-file |
--password=password] [--quiet] [--secure] [--tmpdir=directory-name]
[--username=username] [--verbose] <template-name>
```

```
VBoxManage guestcontrol <uuid | vmname> fsinfo [--domain=domainname]
[--passwordfile=password-file | --password=password] [--human-readable]
[--quiet] [--total] [--username=username] [--verbose] <path>
```

```
VBoxManage guestcontrol <uuid | vmname> stat [--domain=domainname]
[--passwordfile=password-file | --password=password] [--quiet]
[--username=username] [--verbose] <filename>
```

```
VBoxManage guestcontrol <uuid | vmname> list <all | files | processes |
sessions> [--quiet] [--verbose]
```

```
VBoxManage guestcontrol <uuid | vmname> closeprocess [--session-id=ID |
--session-name=name-or-pattern] [--quiet] [--verbose] <PID...>
```

```
VBoxManage guestcontrol <uuid | vmname> closesession [--all |
--session-id=ID | --session-name=name-or-pattern] [--quiet] [--verbose]
```

```
VBoxManage guestcontrol <uuid | vmname> updatega [--quiet] [--verbose]
[--source=guest-additions.ISO] [--wait-start] [-- [argument...]]
```

```
VBoxManage guestcontrol <uuid | vmname> watch [--quiet] [--verbose]
```

```
VBoxManage guestproperty get <uuid | vmname> <property-name> [--verbose]
```

```
VBoxManage guestproperty enumerate <uuid | vmname> [--no-timestamp]
[--no-flags] [--relative] [--old-format] [patterns...]
```

```
VBoxManage guestproperty set <uuid | vmname> <property-name> [property-value
[--flags=flags]]
```

```
VBoxManage guestproperty unset <uuid | vmname> <property-name>
```

```
VBoxManage guestproperty wait <uuid | vmname> <patterns> [--timeout=msec]
[--fail-on-timeout]
```

```
VBoxManage hostonlyif ipconfig <ifname> [--dhcp | --ip=IPv4-address
--netmask=IPv4-netmask | --ipv6=IPv6-address --netmasklengthv6=length]
```

```
VBoxManage hostonlyif create
```

```
VBoxManage hostonlyif remove <ifname>
```

```
VBoxManage hostonlynet add <--name=netname> [--id=netid] <--netmask=mask>
<--lower-ip=address> <--upper-ip=address> [--enable | --disable]
```

```
VBoxManage hostonlynet modify <--name=netname | --id=netid>
[--lower-ip=address] [--upper-ip=address] [--netmask=mask] [--enable |
--disable]
```

```
VBoxManage hostonlynet remove <--name=netname | --id=netid>
```

```
VBoxManage import <ovfname | ovaname> [--dry-run] [--options=keepallmacs
| keepnatmacs | importtovdi] [--vsys=n] [--ostype=ostype] [--vmname=name]
[--settingsfile=file] [--basefolder=folder] [--group=group] [--memory=MB]
[--cpus=n] [--description=text] [--eula=show | accept] [--unit=n]
[--ignore] [--scsitype=BusLogic | LsiLogic] [--disk=path]
[--controller=index] [--port=n]
```

```
VBoxManage import OCI:// --cloud [--ostype=ostype] [--vmname=name]
[--basefolder=folder] [--memory=MB] [--cpus=n] [--description=text]
<--cloudprofile=profile> <--cloudinstanceid=id> [--cloudbucket=bucket]
```

```
VBoxManage list [--long] [--sorted] [bridgedifs | cloudnets |
cloudprofiles | cloudproviders | cpu-profiles | dhcpservers | dvds |
extpacks | floppies | groups | hddbackends | hdds | hostcpuids |
hostdrives | hostdvds | hostfloppies | hostinfo | hostonlyifs |
hostonlynets | intnets | natnets | ostypes | runningvms |
screenshotformats | systemproperties | usbfilters | usbhost | vms |
webcams]
```

```
VBoxManage mediumio <--disk=uuid|filename | --dvd=uuid|filename | --floppy=uuid|
filename> [--password-file=-|filename] formatfat [--quick]
```

```
VBoxManage mediumio <--disk=uuid|filename | --dvd=uuid|filename | --floppy=uuid|
filename> [--password-file=-|filename] cat [--hex] [--offset=byte-offset]
[--size=bytes] [--output=-|filename]
```

```
VBoxManage mediumio <--disk=uuid|filename | --dvd=uuid|filename | --floppy=uuid|
filename> [--password-file=-|filename] stream [--format=image-format]
[--variant=image-variant] [--output=-|filename]
```

```
VBoxManage mediumproperty [disk | dvd | floppy] set <uuid | filename>
<property-name> <property-value>
```

```
VBoxManage mediumproperty [disk | dvd | floppy] get <uuid | filename>
<property-name>
```

```
VBoxManage mediumproperty [disk | dvd | floppy] delete <uuid | filename>
<property-name>
```

```
VBoxManage metrics collect [--detach] [--list] [--period=seconds]
[--samples=count] [* | host | vmname metric-list]
```

```
VBoxManage metrics disable [--list] [* | host | vmname metric-list]
```

```
VBoxManage metrics enable [--list] [* | host | vmname metric-list]
```

```
VBoxManage metrics list [* | host | vmname metric-list]
```

```
VBoxManage metrics query [* | host | vmname metric-list]
```

```
VBoxManage metrics setup [--list] [--periodseconds] [--samplescount] [* |
host | vmname metric-list]
```

```
VBoxManage modifymedium [disk | dvd | floppy] <uuid | filename>
[--autoreset=on | off] [--compact] [--description=description]
[--move=pathname] [--property=name=[value]] [--resize=megabytes |
--resizebyte=bytes] [--setlocation=pathname] [--type=normal | writethrough
| immutable | shareable | readonly | multiattach]
```

```
VBoxManage modifynvram <uuid | vmname> inituefivarstore
```

```
VBoxManage modifynvram <uuid | vmname> enrollmssignatures
```

```
VBoxManage modifynvram <uuid | vmname> enrollorclpk
```

```
VBoxManage modifynvram <uuid | vmname> enrollpk [--platform-key=filename]
[--owner-uuid=uuid]
```

```
VBoxManage modifynvram <uuid | vmname> enrollmok [--mok=filename]
[--owner-uuid=uuid]
```

```
VBoxManage modifynvram <uuid | vmname> listvars
```

```
VBoxManage modifynvram <uuid | vmname> queryvar [--name=name]
[--filename=filename]
```

```
VBoxManage modifynvram <uuid | vmname> deletevar [--name=name]
[--owner-uuid=uuid]
```

```
VBoxManage modifynvram <uuid | vmname> changevar [--name=name]
[--filename=filename]
```

```
VBoxManage modifyvm <uuid | vmname> [--name=name] [--groups=group
[,group...]] [--description=description] [--os-type=OS-type]
[--icon-file=filename] [--memory=size-in-MB] [--page-fusion=on | off]
[--vram=size-in-MB] [--acpi=on | off] [--ioapic=on | off]
[--hardware-uuid=UUID] [--cpus=CPU-count] [--cpu-hotplug=on | off]
[--plug-cpu=CPU-ID] [--unplug-cpu=CPU-ID] [--cpu-execution-cap=number]
[--pae=on | off] [--long-mode=on | off] [--ibpb-on-vm-exit=on | off]
[--ibpb-on-vm-entry=on | off] [--spec-ctrl=on | off]
[--l1d-flush-on-sched=on | off] [--l1d-flush-on-vm-entry=on | off]
[--mds-clear-on-sched=on | off] [--mds-clear-on-vm-entry=on | off]
[--cpu-profile=host | Intel 8086 | Intel 80286 | Intel 80386] [--hpet=on
| off] [--hwvirtex=on | off] [--triple-fault-reset=on | off] [--apic=on |
off] [--x2apic=on | off] [--paravirt-provider=none | default | legacy |
minimal | hyperv | kvm] [--paravirt-debug=key=value[,key=value...]]
```

[--nested-paging=on | off] [--large-pages=on | off] [--vtx-vpid=on | off]
[--vtx-ux=on | off] [--nested-hw-virt=on | off] [--virt-vmsave-vmload=on |
off] [--accelerate-3d=on | off] [--accelerate-2d-video=on | off]
[--chipset=ich9 | piix3] [--iommu=none | automatic | amd | intel]
[--tpm-type=none | 1.2 | 2.0 | host | swtpm] [--tpm-location=*location*]
[--bios-logo-fade-in=on | off] [--bios-logo-fade-out=on | off]
[--bios-logo-display-time=*msec*] [--bios-logo-image-path=*pathname*]
[--bios-boot-menu=disabled | menuonly | messageandmenu]
[--bios-apic=disabled | apic | x2apic] [--bios-system-time-offset=*msec*]
[--bios-pxe-debug=on | off] [--system-uuid-le=on | off] [--boot*X*= none |
floppy | dvd | disk | net] [--rtc-use-utc=on | off]
[--graphicscontroller=none | vboxvga | vmsvga | vboxsvga]
[--snapshot-folder=default | *pathname*] [--firmware=bios | efi | efi32 |
efi64] [--guest-memory-balloon=*size-in-MB*] [--default-frontend=default |
name] [--vm-process-priority=default | flat | low | normal | high]

VBoxManage modifyvm <*uuid* | *vmname*> [--nic*N*= none | null | nat |
bridged | intnet | hostonly | hostonlynet | generic | natnetwork |
cloud] [--nic-type*N*= Am79C970A | Am79C973 | 82540EM | 82543GC | 82545EM
| virtio] [--cable-connected*N*= on | off] [--nic-trace*N*= on | off]
[--nic-trace-file*N*=*filename*] [--nic-property*N*=*name*= [*value*]]
[--nic-speed*N*=*kbps*] [--nic-boot-prio*N*=*priority*] [--nic-promisc*N*= deny |
allow-vms | allow-all] [--nic-bandwidth-group*N*= none | *name*]
[--bridge-adapter*N*= none | *device-name*] [--cloud-network*N*=*network-name*]
[--host-only-adapter*N*= none | *device-name*] [--host-only-net*N*=*network-name*]
[--intnet*N*=*network-name*] [--nat-network*N*=*network-name*]
[--nic-generic-drv*N*=*driver-name*] [--mac-address*N*= auto | *MAC-address*]

VBoxManage modifyvm <*uuid* | *vmname*> [--nat-net*N*= *network* | default]
[--nat-pf*N*= [*rule-name*],tcp | udp,[*host-IP*],*hostport*,[*guest-IP*],*guestport*]
[--nat-pf*N*=delete=*rule-name*] [--nat-tftp-prefix*N*=*prefix*]
[--nat-tftp-file*N*=*filename*] [--nat-tftp-server*N*=*IP-address*]
[--nat-bind-ip*N*=*IP-address*] [--nat-dns-pass-domain*N*= on | off]
[--nat-dns-proxy*N*= on | off] [--nat-dns-host-resolver*N*= on | off]
[--nat-localhostreachable*N*= on | off] [--nat-settings*N*=[*mtu*],[*socksnd*],
[*sockrcv*],[*tcpsnd*],[*tcprcv*]] [--nat-alias-mode*N*= default | [log],
[proxyonly],[sameports]]

VBoxManage modifyvm <*uuid* | *vmname*> [--mouse=ps2 | usb | usbtablet |
usbmultitouch | usbmtscreenpluspad] [--keyboard=ps2 | usb] [--uart*N*=
off | *IO-base IRQ*] [--uart-mode*N*= disconnected | server*pipe* | client*pipe*
| tcpserver*port* | tcpclient*hostname*:*port* | file*filename* | *device-name*]
[--uart-type*N*= 16450 | 16550A | 16750] [--lpt-mode*N*=*device-name*] [--lpt*N*=
off | *IO-base IRQ*] [--audio-controller=ac97 | hda | sb16]
[--audio-codec=stac9700 | ad1980 | stac9221 | sb16] [--audio-driver=none

```
| default | null | dsound | was | oss | alsa | pulse | coreaudio]
[--audio-enabled=on | off] [--audio-in=on | off] [--audio-out=on | off]
[--clipboard-mode=disabled | hosttoguest | guesttohost | bidirectional]
[--clipboard-file-transfers=enabled | disabled] [--drag-and-drop=disabled
| hosttoguest | guesttohost | bidirectional] [--monitor-count=number]
[--usb-ehci=on | off] [--usb-ohci=on | off] [--usb-xhci=on | off]
[--usb-rename=old-name  new-name]
```

```
VBoxManage modifyvm <uuid | vmname> [--recording=on | off]
[--recording-screens=all | none | screen-ID[,screen-ID...]]
[--recording-file=filename] [--recording-max-size=MB]
[--recording-max-time=msec] [--recording-opts= key=value[,key=value...]]
[--recording-video-fps=fps] [--recording-video-rate=rate]
[--recording-video-res=widthxheight]
```

```
VBoxManage modifyvm <uuid | vmname> [--vrde=on | off]
[--vrde-property=property-name= [property-value]] [--vrde-extpack=default |
name] [--vrde-port=port] [--vrde-address=hostip] [--vrde-auth-type=null |
external | guest] [--vrde-auth-library=default | name]
[--vrde-multi-con=on | off] [--vrde-reuse-con=on | off]
[--vrde-video-channel=on | off] [--vrde-video-channel-quality=percent]
```

```
VBoxManage modifyvm <uuid | vmname> [--teleporter=on | off]
[--teleporter-port=port] [--teleporter-address=address | empty]
[--teleporter-password=password] [--teleporter-password-file=filename |
stdin] [--cpuid-portability-level=level] [--cpuid-set=leaf [:subleaf]
eax ebx ecx edx] [--cpuid-remove=leaf [:subleaf]] [--cpuid-remove-all]
```

```
VBoxManage modifyvm <uuid | vmname> [--tracing-enabled=on | off]
[--tracing-config=string] [--tracing-allow-vm-access=on | off]
```

```
VBoxManage modifyvm <uuid | vmname> [--usb-card-reader=on | off]
```

```
VBoxManage modifyvm <uuid | vmname> [--autostart-enabled=on | off]
[--autostart-delay=seconds]
```

```
VBoxManage modifyvm <uuid | vmname> [--guest-debug-provider=none |
native | gdb | kd] [--guest-debug-io-provider=none | tcp | udp | ipc]
[--guest-debug-address=IP-Address | path] [--guest-debug-port=port]
```

```
VBoxManage modifyvm <uuid | vmname> [--pci-attach=host-PCI-address
[@guest-PCI-bus-address]] [--pci-detach=host-PCI-address]
```

```
VBoxManage modifyvm <uuid | vmname> [--testing-enabled=on | off]
[--testing-mmio=on | off] [--testing-cfg-dwordidx=value]
```

```
VBoxManage movevm <uuid | vmname> [--type=basic] [--folder=folder-name]
```

```
VBoxManage natnetwork add [--disable | --enable] <--netname=name>
<--network=network> [--dhcp=on|off] [--ipv6=on|off] [--loopback-4=rule]
[--loopback-6=rule] [--port-forward-4=rule] [--port-forward-6=rule]
```

```
VBoxManage natnetwork list [filter-pattern]
```

```
VBoxManage natnetwork modify [--dhcp=on|off] [--disable | --enable]
<--netname=name> <--network=network> [--ipv6=on|off] [--loopback-4=rule]
[--loopback-6=rule] [--port-forward-4=rule] [--port-forward-6=rule]
```

```
VBoxManage natnetwork remove <--netname=name>
```

```
VBoxManage natnetwork start <--netname=name>
```

```
VBoxManage natnetwork stop <--netname=name>
```

```
VBoxManage registervm <filename> --passwordfile
```

```
VBoxManage setextradata <global | uuid | vmname> <keyword> [value]
```

```
VBoxManage setproperty <property-name> <property-value>
```

```
VBoxManage sharedfolder add <uuid | vmname> <--name=name>
<--hostpath=hostpath> [--readonly] [--transient] [--automount]
[--auto-mount-point=path]
```

```
VBoxManage sharedfolder remove <uuid | vmname> <--name=name>
[--transient]
```

```
VBoxManage showmediuminfo [disk | dvd | floppy] <uuid | filename>
```

```
VBoxManage showvminfo <uuid | vmname> [--details] [--machinereadable]
[--password-id] [--password]
```

```
VBoxManage showvminfo <uuid | vmname> <--log=index> [--password-idid]
[--passwordfile|-]
```

```
VBoxManage signova <ova> <--certificate=file> <--private-key=file>
[--private-key-password-file=password-file | --private-key-password=password]
[--digest-type=type] [--pkcs7 | --no-pkcs7] [--intermediate-cert=file]
[--force] [--verbose] [--quiet] [--dry-run]
```

```
VBoxManage snapshot <uuid | vmname>
```

```
VBoxManage snapshot <uuid | vmname> take <snapshot-name>
[--description=description] [--live] [--uniquename
Number,Timestamp,Space,Force]
```

```
VBoxManage snapshot <uuid | vmname> delete <snapshot-name>
```

```
VBoxManage snapshot <uuid | vmname> restore <snapshot-name>
```

```
VBoxManage snapshot <uuid | vmname> restorecurrent
```

```
VBoxManage snapshot <uuid | vmname> edit <snapshot-name | --current>
[--description=description] [--name=new-name]
```

```
VBoxManage snapshot <uuid | vmname> list [--details | --machinereadable]
```

```
VBoxManage snapshot <uuid | vmname> showvminfo <snapshot-name>
```

```
VBoxManage startvm [--putenv=name[=value]] [--type=<gui|headless|sdl|
separate>] [--password=file] [--password-id=password-identifier] <uuid |
vmname...>
```

```
VBoxManage storageattach <uuid | vmname> <--storagectl=name>
[--bandwidthgroup=name | none] [--comment=text] [--device=number]
[--discard=on | off] [--encodedlun=lun] [--forceunmount]
[--hotpluggable=on | off] [--initiator=initiator] [--intnet] [--lun=lun]
[--medium=none | emptydrive | additions | uuid | filename | host:drive |
iscsi] [--mtype=normal | writethrough | immutable | shareable |
readonly | multiattach] [--nonrotational=on | off] [--passthrough=on |
off] [--passwordfile=file] [--password=password] [--port=number]
[--server=name | ip] [--setparentuuid=uuid] [--setuuid=uuid]
[--target=target] [--tempeject=on | off] [--tport=port] [--type=dvddrive |
fdd | hdd] [--username=username]
```

```
VBoxManage storagectl <uuid | vmname> <--name=controller-name> [--add=floppy
| ide | pcie | sas | sata | scsi | usb] [--controller=BusLogic |
I82078 | ICH6 | IntelAhci | LSILogic | LSILogicSAS | NVMe | PIIX3 |
PIIX4 | USB | VirtIO] [--bootable=on | off] [--hostiocache=on | off]
[--portcount=count] [--remove] [--rename=new-controller-name]
```

```
VBoxManage unattended detect <--iso=install-iso> [--machine-readable]
```

```
VBoxManage unattended install <uuid | vmname> <--iso=install-iso>
[--user=login] [--password=password] [--password-file=file]
[--full-user-name=name] [--key=product-key] [--install-additions]
[--no-install-additions] [--additions-iso=add-iso] [--install-txs]
[--no-install-txs] [--validation-kit-iso=testing-iso] [--locale=ll_CC]
[--country=CC] [--time-zone=tz] [--hostname=fqdn]
[--package-selection-adjustment=keyword] [--dry-run]
[--auxiliary-base-path=path] [--image-index=number] [--script-template=file]
[--post-install-template=file] [--post-install-command=command]
[--extra-install-kernel-parameters=params] [--language=lang]
[--start-vm=session-type]
```

```
VBoxManage unregistervm <uuid | vmname> [--delete] [--delete-all]
```

```
VBoxManage updatecheck perform [--machine-readable]
```

```
VBoxManage updatecheck list [--machine-readable]
```

```
VBoxManage updatecheck modify [--disable | --enable] [--channel=stable |
withbetas | all] [--frequency=days]
```

```
VBoxManage usbdevsource add <source-name> <--backend=backend>
<--address=address>
```

```
VBoxManage usbdevsource remove <source-name>
```

```
VBoxManage usbfilter add <index,0-N> <--target=<uuid | vmname | global>>
<--name=string> <--action=ignore | hold> [--active=yes | no]
[--vendorid=XXXX] [--productid=XXXX] [--revision=IIFF]
[--manufacturer=string] [--product=string] [--port=hex] [--remote=yes | no]
[--serialnumber=string] [--maskedinterfaces=XXXXXXXX]
```

```
VBoxManage usbfilter modify <index,0-N> <--target=<uuid | vmname |
global>> [--name=string] [--action=ignore | hold] [--active=yes | no]
[--vendorid=XXXX| ""] [--productid=XXXX| ""] [--revision=IIFF| ""]
[--manufacturer=string| ""] [--product=string| ""] [--port=hex] [--remote=yes
| no] [--serialnumber=string| ""] [--maskedinterfaces=XXXXXXXX]
```

```
VBoxManage usbfilter remove <index,0-N> <--target=<uuid | vmname |
global>>
```

Each time `VBoxManage` is invoked, only one command can be executed. However, a command might support several subcommands which then can be invoked in one single call. The following sections provide detailed reference information on then different commands.

General Options

- -v|--version: Show the version of this tool and exit.
- --nologo: Suppress the output of the logo information. This option is useful for scripts.
- --settingspw: Specify a settings password.
- --settingspwfile: Specify a file containing the settings password.

The settings password is used for certain settings which need to be stored in encrypted form for security reasons. At the moment, the only encrypted setting is the iSCSI initiator secret, see VBoxManage storageattach. As long as no settings password is specified, this information is stored in *plain text*. After using the --settingspw|--settingspwfile option once, it must be always used. Otherwise, the encrypted setting cannot be unencrypted.

VBoxManage

Oracle VM VirtualBox command-line interface

Synopsis

```
VBoxManage [-q | --nologo] [--settingspw=password]
[--settingspwfile=pw-file] [@response-file] [subcommand]
```

```
VBoxManage help [subcommand]
```

```
VBoxManage commands
```

```
VBoxManage [-V | --version]
```

```
VBoxManage [--dump-build-type]
```

Description

The `VBoxManage` command is the command-line interface (CLI) for the Oracle VM VirtualBox software. The CLI supports all the features that are available with the Oracle VM VirtualBox

graphical user interface (GUI). In addition, you can use the `VBoxManage` command to manage the features of the virtualization engine that cannot be managed by the GUI.

Each time you invoke the `VBoxManage` command, only one command is executed. Note that some `VBoxManage` subcommands invoke several subcommands.

Run the `VBoxManage` command from the command line of the host operating system (OS) to control Oracle VM VirtualBox software.

The `VBoxManage` command is stored in the following locations on the host system:

- *Linux:* `/usr/bin/VBoxManage`
- *Mac OS X:* `/Applications/VirtualBox.app/Contents/MacOS/VBoxManage`
- *Oracle Solaris:* `/opt/VirtualBox/bin/VBoxManage`
- *Windows:* `C:\Program Files\Oracle\VirtualBox\VBoxManage.exe`

In addition to managing virtual machines (VMs) with this CLI or the GUI, you can use the `VBoxHeadless` CLI to manage VMs remotely.

The `VBoxManage` command performs particular tasks by using subcommands, such as `list`, `createvm`, and `startvm`. See the associated information for each `VBoxManage` subcommand.

If required, specify the VM by its name or by its Universally Unique Identifier (UUID).

Use the `VBoxManage list vms` command to obtain information about all currently registered VMs, including the VM names and associated UUIDs.

Note that you must enclose the entire VM name in double quotes if it contains spaces.

General Options

`--nologo`
Suppresses the output of the logo information, which is useful for scripts.
The short version of this option is `-q`.

`--settingspw=[`*password*`]`
Specifies the settings password. You can optionally specify the password as an argument to this option. If you do not specify the password in this way, the `VBoxManage` command prompts you for the password.
The settings password is a security feature that encrypts stored settings, which are stored as plain text by default.
You cannot unencrypt encrypted settings. So, if the settings are encrypted, you must continue to specify the `--settingspw` or `--settingspwfile` option.
Only the iSCSI secret is encrypted at this time.

`--settingspwfile=`*pw-filename*
Specifies the file that contains the settings password.

`--version`
Shows version information about the `VBoxManage` command.
The short version of this option is `-V`.

@response-file
Loads arguments from the specified Bourne shell response file.

subcommand
Specifies one of the `VBoxManage` subcommands, such as `controlvm`, `createvm`, `list`, `modifyvm`, `showvminfo`, `startvm`, `storageattach`, and `storagectl`.
Each subcommand is described in its own command topic, some of which are shown in See Also sections.

Examples

The following command creates a virtual machine called `Win8` and registers it with Oracle VM VirtualBox by using the `--register` option.

```
$ VBoxManage createvm --name "Win8" --register
Virtual machine 'Win8' is created.
UUID: UUID-string
Settings file: '/home/username/VirtualBox VMs/Win8/Win8.vbox'
```

The command output shows that the `Win8` VM is assigned a UUID and an XML machine settings file.

You can use the `VBoxManage showvminfo` command to view the configuration information of a VM.

The following example uses the `VBoxManage modifyvm` command to change the amount of memory for the `Windows XP` VM to be 1024 megabytes:

```
$ VBoxManage modifyvm "Windows XP" --memory 1024
```

Note that you can use the `VBoxManage modifyvm` command even when the VM is powered off.

You can use the `VBoxManage storagectl` command or the `VBoxManage storageattach` command to modify the storage configuration for a VM. For example, to create a SATA storage controller called `sata01` and add it to the `ol7` VM:

```
$ VBoxManage storagectl ol7 --name "sata01" --add sata
```

Use the `VBoxManage startvm` command to start a VM that is currently powered off. For example, to start the `win7` VM:

```
$ VBoxManage startvm win7
```

Use the `VBoxManage controlvm` command to pause or save a VM that is currently running. You can also use this command to modify settings for the VM. For example, to enable audio input for the `ol6u9` VM.

```
$ VBoxManage controlvm ol6u9 audioin on
```

See Also

VBoxManage controlvm, VBoxManage createvm, VBoxManage list, VBoxManage modifyvm, VBoxManage showvminfo, VBoxManage startvm, VBoxManage storageattach, VBoxManage storagectl

VBoxManage adoptstate

Change a virtual machine's state based on a saved state file

Synopsis

```
VBoxManage adoptstate <uuid | vmname> <state-filename>
```

Description

The `VBoxManage adoptstate` command enables you to change the state of a virtual machine (VM) to a state described in a saved state file (`.sav`). This action is referred to as a VM *adopting* a saved state file. The saved state file must be separate from the VM configuration.

When you start the VM after adopting the saved state, the VM restores its state from the saved state file.

Only use this command for custom deployments.

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or name of the VM.

state-filename
Specifies the name of the saved state file.

Examples

The following command adopts a saved state file called `mystate.sav` by a VM called `vm2`. A subsequent start of the VM called `vm2` restores the state from the saved state file `mystate.sav`.

```
$ VBoxManage adoptstate vm2 /home/user/mystate.sav
```

See Also

VBoxManage discardstate

VBoxManage bandwidthctl

Manage bandwidth groups

Synopsis

```
VBoxManage bandwidthctl <uuid | vmname> add <bandwidth-group-name>
<--limit=bandwidth-limit[k|m|g|K|M|G]> <--type=disk | network>
```

```
VBoxManage bandwidthctl <uuid | vmname> list [--machinereadable]
```

```
VBoxManage bandwidthctl <uuid | vmname> remove <bandwidth-group-name>
```

```
VBoxManage bandwidthctl <uuid | vmname> set <bandwidth-group-name>
<--limit=bandwidth-limit[k|m|g|K|M|G]>
```

Description

The `VBoxManage bandwidthctl` command enables you to manage bandwidth groups for virtual machines (VMs). A bandwidth group specifies the bandwidth limit for the disks or for the network adapters of a VM.

Note that a network bandwidth limit applies only to the outbound traffic from the VM. The inbound traffic is unlimited.

Create a Bandwidth Group

```
VBoxManage bandwidthctl <uuid | vmname> add <bandwidth-group-name>
<--limit=bandwidth-limit[k|m|g|K|M|G]> <--type=disk | network>
```

The `VBoxManage bandwidthctl add` command creates a bandwidth group for the specified VM. You must specify whether the bandwidth group is for disks or for networks, and specify the bandwidth limit.

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or the name of the VM.

bandwidth-group-name
Specifies the name of the bandwidth group.

`--type=disk|network`
Specifies the type of the bandwidth group: `disk` and `network`. For more information, see Limiting Bandwidth for Disk Images or Limiting Bandwidth for Network Input/Output.

`--limit=` *bandwidth-limit* `[k|m|g|K|M|G]`
Specifies the bandwidth limit for a bandwidth group. The default unit is megabytes per second. You can modify this value while the VM is running.
You can change the unit by appending one of the following unit specifiers to the bandwidth limit:

- `k` – kilobits per second
- `m` – megabits per second
- `g` – gigabits per second
- `K` – kilobytes per second
- `M` – megabytes per second

- `G` – gigabytes per second

List Bandwidth Groups

```
VBoxManage bandwidthctl <uuid | vmname> list [--machinereadable]
```

The `VBoxManage bandwidthctl list` command lists the all the bandwidth groups that have been defined for the specified VM. Use the `--machinereadable` option to produce the output in a machine-readable format, which uses name-value pairs.

uuid* | *vmname
Specifies the UUID or the name of the VM.

`--machinereadable`
Outputs the information about the bandwidth groups in name-value pairs.

Remove a Bandwidth Group

```
VBoxManage bandwidthctl <uuid | vmname> remove <bandwidth-group-name>
```

The `VBoxManage bandwidthctl remove` command removes a bandwidth group.

> **Note:**
>
> To successfully remove a bandwidth group, ensure that it is not referenced by any disk or adapter in the running VM.

uuid* | *vmname
Specifies the UUID or the name of the VM.

bandwidth-group-name
Specifies the name of the bandwidth group.

Modify the Bandwidth Limit of a Bandwidth Group

```
VBoxManage bandwidthctl <uuid | vmname> set <bandwidth-group-name>
<--limit=bandwidth-limit[k|m|g|K|M|G]>
```

The `VBoxManage bandwidthctl set` command modifies the bandwidth limit for a bandwidth group.

uuid* | *vmname
Specifies the UUID or the name of the VM.

bandwidth-group-name
Specifies the name of the bandwidth group.

`--limit=` *bandwidth-limit* `[k|m|g|K|M|G]`
Specifies the bandwidth limit for a bandwidth group. The default unit is megabytes per second. You can modify this value while the VM is running.
You can change the unit by appending one of the following unit specifiers to the bandwidth limit:

- `k` – kilobits per second
- `m` – megabits per second
- `g` – gigabits per second
- `K` – kilobytes per second
- `M` – megabytes per second
- `G` – gigabytes per second

Examples

The following example shows how to use the `VBoxManage bandwidthctl` command to create the `Limit` bandwidth group and set the limit to 20 Mbps. Then use the `VBoxManage modifyvm` command to assign this bandwidth group to the first and second adapters of the `vm1` VM.

```
$ VBoxManage bandwidthctl "vm1" add Limit --type network --limit 20m
$ VBoxManage modifyvm "vm1" --nicbandwidthgroup1 Limit
$ VBoxManage modifyvm "vm1" --nicbandwidthgroup2 Limit
```

You can dynamically modify the limit of a bandwidth group while the VM is running. The following example shows how to modify the limit for the `Limit` bandwidth group from 20 Mbps to 100 kbps:

```
$ VBoxManage bandwidthctl "vm1" set Limit --limit 100k
```

The following command disables shaping for all adapters in the `Limit` bandwidth group by specifying a limit of zero (`0`):

```
$ VBoxManage bandwidthctl "vm1" set Limit --limit 0
```

VBoxManage checkmediumpwd

Check encryption password on a DEK-encrypted medium or a disk image

Synopsis

`VBoxManage checkmediumpwd` <*uuid* | *filename*> <*password-file*>

Description

The `VBoxManage checkmediumpwd` command checks the current encryption password on a DEK-encrypted medium or a disk image. See Encrypting Disk Images.

The command response indicates if the specified password is correct.

uuid | filename
Specifies the Universally Unique Identifier (UUID) or the absolute path name of the medium or image.

password-file
Specifies the password to check. The password can be the absolute path name of a password file on the host OS or the dash character (-) to prompt you for the password on the command line.

Examples

The following example checks the encryption password for the `ol7u4-1.vdi` disk image. The password is contained in a file called `pwfile`.

The command returns a message indicating that the specified password is correct.

```
$ VBoxManage checkmediumpwd "$HOME/VirtualBox VMs/ol7u4/ol7u4-1.vdi" /home/user/pwfile
  The given password is correct
```

See Also

VBoxManage encryptmedium

VBoxManage clonemedium

Create a clone of a medium

Synopsis

```
VBoxManage clonemedium <uuid | source-medium> <uuid | target-medium> [disk |
dvd | floppy] [--existing] [--format=VDI | VMDK | VHD | RAW | other]
[--variant=Standard|Fixed|Split2G|Stream|ESX...]
```

Description

The `VBoxManage clonemedium` command enables you to clone an existing medium (virtual disk, DVD, or floppy), which is typically an image file. Only the Universally Unique Identifier (UUID) differs between the original image and the cloned image.

You can use the Virtual Media Manager to transfer the cloned image to another host system or reimport it into Oracle VM VirtualBox. See The Virtual Media Manager and Cloning Disk Images.

uuid | source-medium
Specifies the UUID or the absolute or relative file name of the source medium to clone. You can specify the UUID of the medium only if it is registered. Use the `VBoxManage list hdds` command to list registered images.

uuid | target-medium
Specifies the UUID or the absolute or relative file name of the target (clone) medium. You can specify the UUID of the target medium only if it is registered. Use the `VBoxManage list hdds` command to list registered images.

`disk | dvd | floppy`
Specifies the type of the medium to clone. Valid values are `disk`, `dvd`, and `floppy`. The default value is `disk`.

`--existing`
Performs the clone operation by overwriting an existing target medium. The result is that only the portion of the source medium that fits into the existing target medium is copied.
If the target medium is smaller than the source, only the portion of the source medium up to the size of the target medium is copied.
If the target medium is larger than the source, the remaining part of the target medium is unchanged.

`--format`
Specifies the file format of the target medium if it differs from the format of the source medium. Valid values are `VDI`, `VMDK`, `VHD`, `RAW`, and *other*.

`--variant=Standard | Fixed | Split2G | Stream | ESX [,...]`
Specifies the file format variant for the target medium, which is a comma-separated list of variants. Following are the valid values:

- `Standard` is the default disk image type, which has a dynamically allocated file size.
- `Fixed` uses a disk image that has a fixed file size.
- `Split2G` indicates that the disk image is split into 2GB segments. This value is for VMDK only.
- `Stream` optimizes the disk image for downloading. This value is for VMDK only.
- `ESX` is used for some VMWare products. This value is for VMDK only.

Note that not all variant combinations are valid. Specifying incompatible variant values in the list will produce an error message.

> **Note:**
>
> For compatibility with earlier versions of Oracle VM VirtualBox, you can use the `clonevdi` and `clonehd` commands instead of the `clonemedium` command.

Examples

The following command creates a clone of the `disk01.vdi` disk image file. The clone is called `disk02.vdi`.

```
$ VBoxManage clonemedium disk01.vdi disk02.vdi
```

The following command creates a clone of the `disk01.vdi` disk image file. The clone is in VMDK format and is called `disk02.vmdk`.

```
$ VBoxManage clonemedium disk01.vdi disk02.vmdk --format VMDK
```

See Also

VBoxManage list

VBoxManage clonevm

Create a clone of an existing virtual machine

Synopsis

```
VBoxManage clonevm <vmname|uuid> [--basefolder=basefolder]
[--groups=group,...] [--mode=machine | --mode=machinechildren |
--mode=all] [--name=name] [--options=option,...] [--register]
[--snapshot=snapshot-name] [--uuid=uuid]
```

Description

The `VBoxManage clonevm` command creates a clone of an existing virtual machine (VM). The clone can be a full copy of the VM or a linked copy of a VM.

You must specify the name or the universal unique identifier (UUID) of the VM you want to clone.

Command Operand and Options

The following list describes the operand and the options that you can use with the `VBoxManage clonevm` command:

vmname|uuid
Specifies the name or UUID of the VM to clone.

`--basefolder=` ***basefolder***
Specifies the name of the folder in which to save the configuration for the new VM.

`--groups=` ***group*** **`,...`**
Assigns the clone to the specified group or groups. If you specify more than one group, separate each group name with a comma.
Note that each group is identified by a group ID that starts with a slash character (`/`) so that groups can be nested. By default, a clone is always assigned membership to the `/` group.

`--mode=machine|machineandchildren|all`
Specifies which of the following cloning modes to use:

- `machine` mode clones the current state of the existing VM without any snapshots. This is the default mode.
- `machineandchildren` mode clones the snapshot specified by by the `--snapshot` option and all child snapshots.
- `all` mode clones all snapshots and the current state of the existing VM.

`--name=` *`name`*
Specifies a new name for the new VM. The default value is *`original-name`* `Clone` where *original-name* is the original name of the VM.

`--options=` *`option`* `,...`
Specifies how to create the new clone.
The `--options` argument can be used multiple times to enable multiple options, or the options can be given as a comma separated list. The options are case insensitive.
The following options (case-insensitive) are recognized:

`Link`
Creates a linked clone from a snapshot only.

`KeepAllMACs`
Specifies that the new clone reuses the MAC addresses of each virtual network card from the existing VM.
If you do not specify this option or the `--options=keepnatmacs` option, the default behavior is to reinitialize the MAC addresses of each virtual network card.

`KeepNATMACs`
Specifies that the new clone reuses the MAC addresses of each virtual network card from the existing VM when the network type is NAT.
If you do not specify this option or the `KeepAllMACs` option, the default behavior is to reinitialize the MAC addresses of each virtual network card.

`KeepDiskNames`
Specifies that the new clone reuses the disk image names from the existing VM. By default, disk images are renamed.

`KeepHwUUIDs`
Specifies that the new clone reuses the hardware IDs from the existing VM. By default, new UUIDs are used.

`--register`
Automatically registers the new clone in this Oracle VM VirtualBox installation. You can manually register the new VM later by using the `VBoxManage registervm` command. See VBoxManage registervm.

`--snapshot=` *`snapshot-name`*
Specifies the snapshot on which to base the new VM. By default, the clone is created from the current state of the specified VM.

`--uuid=` *`uuid`*
Specifies the UUID for the new VM. Ensure that this ID is unique for the Oracle VM VirtualBox instance if you decide to register this new VM. By default, Oracle VM VirtualBox provides a new UUID.

Examples

The following command creates and registers an exact clone of the `ol7` VM. The clone is called `ol7-dev-001`.

The new clone includes all of the source VM's snapshots. The new VM also reuses all network interface MAC addresses, disk names, and UUIDs from the source VM.

```
$ VBoxManage clonevm ol7 --name="ol7-dev-001" --register --mode=all \
    --options=keepallmacs --options=keepdisknames --options=keephwuuids
```

The following command creates and registers a clone of the `Snapshot 1` snapshot of the `ol7` VM. The clone is called `ol7-dev-002`.

```
$ VBoxManage clonevm ol7 --name="ol7-dev-002" --register --snapshot="Snapshot 1"
```

See Also

VBoxManage registervm

VBoxManage closemedium

Remove a hard disk, DVD, or floppy image from the media registry

Synopsis

```
VBoxManage closemedium [disk | dvd | floppy] <uuid | filename> [--delete]
```

Description

The `VBoxManage closemedium` command removes a hard disk, DVD, or floppy image from the list of known media used by Oracle VM VirtualBox. The image is then unavailable for selection in the Virtual Media Manager.

To use this command, the image must not be attached to any VMs.

Optionally, you can request that the image be deleted.

disk|dvd|floppy
Specifies the type of medium. Valid values are `disk` (hard drive), `dvd`, or `floppy`.

uuid*|*filename
Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.

`--delete`
Deletes the image file.

Examples

The following command removes the disk image file called `disk01.vdi` from the registry.

```
$ VBoxManage closemedium disk01.vdi
```

The following command removes the disk image file called `disk01.vdi` from the registry and deletes the image file.

```
$ VBoxManage closemedium disk01.vdi --delete
```

VBoxManage cloud

Manage the cloud entities

Synopsis

```
VBoxManage cloud <--provider=name> <--profile=name>
list instances [--state=string] [--compartment-id=string]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
list images <--compartment-id=string> [--state=string]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
list vnicattachments <--compartment-id=string> [--filter=instanceId |
vnicId | availabilityDomain=value...]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance create <--domain-name=name> <--image-id=id | --boot-volume-id=id>
<--display-name=name> <--shape=type> <--subnet=id> [--boot-disk-size=size in
GB] [--publicip=true | false] [--privateip=IP address]
[--public-ssh-key=key string...] [--launch-mode=NATIVE | EMULATED |
PARAVIRTUALIZED] [--cloud-init-script-path=path to a script]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance info <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance terminate <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance start <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance pause <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
instance reset <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image create <--display-name=name> [--bucket-name=name]
[--object-name=name] [--instance-id=unique id]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image info <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image delete <--id=unique id>
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image import <--id=unique id> [--bucket-name=name] [--object-name=name]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
image export <--id=unique id> <--display-name=name> [--bucket-name=name]
[--object-name=name]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
network setup [--gateway-os-name=string] [--gateway-os-version=string]
[--gateway-shape=string] [--tunnel-network-name=string]
[--tunnel-network-range=string] [--proxy=string] [--compartment-id=string]
```

```
VBoxManage cloud <--provider=name> <--profile=name>
network create <--name=string> <--network-id=string> [--enable | --disable]
```

```
VBoxManage cloud network update <--name=string> [--network-id=string]
[--enable | --disable]
```

```
VBoxManage cloud network delete <--name=string>
```

```
VBoxManage cloud >network info <--name=string>
```

Description

Common options

The word "cloud" is an umbrella for all commands related to the interconnection with the Cloud. The next common options must be placed between the "cloud" and the following sub-commands:

--provider=*name*
Short cloud provider name.

--profile=*name*
Cloud profile name.

cloud list instances

```
VBoxManage cloud <--provider=name> <--profile=name>
list instances [--state=string] [--compartment-id=string]
```

Displays the list of the instances for a specified compartment.

--state*"running/paused/terminated"*
The state of cloud instance. The possible states are "running/paused/terminated" at moment. If the state isn't provided the list of instances with all possible states is returned.

`--compartment-id`
A compartment is the logical container used to organize and isolate cloud resources. The different cloud providers can have the different names for this entity.

cloud list images

```
VBoxManage cloud <--provider=name> <--profile=name>
list images <--compartment-id=string> [--state=string]
```

Displays the list of the images for a specified compartment.

--state=available|disabled|deleted
The state of cloud image. The possible states are `available`, `disabled` and `deleted` at moment. If the state isn't provided the list of images with all possible states is returned.

`--compartment-id`
A compartment is the logical container used to organize and isolate cloud resources. The different cloud providers can have the different names for this entity.

cloud list vnic attachments

```
VBoxManage cloud <--provider=name> <--profile=name>
list vnicattachments <--compartment-id=string> [--filter=instanceId |
vnicId | availabilityDomain=value...]
```

Displays the list of the vnic attachments for a specified compartment.

--filter={instanceId|vnicId|domainName}=*string*
Filters are used to narrow down the set of Vnic attachments of interest. This parameter is repeatible. The possible filter types are "instanceId" or "vnicId" or "availabilityDomain" at moment. The form is "type=[value]" and can be repeated. In instance, "--filter instanceId=ocid1.instance.oc1.iad.anuwcl...js6 --filter vnicId=ocid1.vnic.oc1.iad.abuwcl...jsm --filter domainName=ergw:US-ASHBURN-AD-2". But in most cases, this is redundant and one filter is enough. If the filter isn't provided the whole list of vnic attachments for a specified compartment is returned.

`--compartment-id`
A compartment is the logical container used to organize and isolate cloud resources. The different cloud providers can have the different names for this entity.

cloud instance create

```
VBoxManage cloud <--provider=name> <--profile=name>
instance create <--domain-name=name> <--image-id=id | --boot-volume-id=id>
<--display-name=name> <--shape=type> <--subnet=id> [--boot-disk-size=size in
GB] [--publicip=true | false] [--privateip=IP address]
[--public-ssh-key=key string...] [--launch-mode=NATIVE | EMULATED |
PARAVIRTUALIZED] [--cloud-init-script-path=path to a script]
```

Creates new instance in the Cloud. There are two standard ways to create an instance in the Cloud: 1. Create an instance from an existing custom image. 2. Create an instance from an existing bootable volume. This bootable volume shouldn't be attached to any instance. For the 1st approach next parameters are required: image-id, boot-disk-size. For the 2nd approach next parameters are required: boot-volume-id. The rest parameters are common for both cases: display-name, launch-mode, subnet-id, publicIP, privateIP, shape, domain.

`--domain-name`
Cloud domain where new instance is created.

--image-id
Unique identifier which fully identifies a custom image in the Cloud.

--boot-volume-id
Unique identifier which fully identifies a boot volume in the Cloud.

--display-name
Name for new instance in the Cloud.

--shape
The shape of instance, defines the number of CPUs and RAM memory.

--subnet
Unique identifier which fully identifies an existing subnet in the Cloud which will be used by the instance.

--boot-disk-size
The size of bootable image in GB. Default is 50GB.

--publicip
Whether the instance will have a public IP or not.

--privateip
Private IP address for the created instance.

--public-ssh-key
Public SSH key used to connect to the instance via SSH. This parameter may be repeated if you plan to use more than one key as: "--public-ssh-key=firstSSHKey --public-ssh-key=secondSSHKey".

--launch-mode
The most known values here may be EMULATED, NATIVE, PARAVIRTUALIZED.

--cloud-init-script-path
Absolute path to the user cloud-init script.

cloud instance info

Display information about a cloud instance with a specified id.

--id
Unique identifier which fully identify the instance in the Cloud.

cloud instance termination

Delete a cloud instance with a specified id.

--id
Unique identifier which fully identify the instance in the Cloud.

cloud instance start

Start a cloud instance with a specified id.

--id
Unique identifier which fully identify the instance in the Cloud.

cloud instance pause

Pause a cloud instance with a specified id.

--id
Unique identifier which fully identify the instance in the Cloud.

cloud instance reset

Force reset a cloud instance with a specified id.

--id
Unique identifier which fully identify the instance in the Cloud.

cloud image create

```
VBoxManage cloud <--provider=name> <--profile=name>
image create <--display-name=name> [--bucket-name=name]
[--object-name=name] [--instance-id=unique id]
```

Creates new image in the Cloud. There are two standard ways to create an image in the Cloud: 1. Create an image from an object in the Cloud Storage; 2. Create an image from an existing cloud instance. For the 1st approach next parameters are required: bucket-name - cloud bucket name where an object is located; object-name - name of object in the bucket; display-name - name for new image in the Cloud. For the 2d approach next parameters are required: instance-id - Id of instance in the Cloud; display-name - name for new image in the Cloud.

--display-name
Name for new image in the Cloud.

--bucket-name
Cloud bucket name where an object is located.

--object-name
Name of object in the bucket.

--instance-id
Unique identifier which fully identifies the instance in the Cloud.

cloud image info

```
VBoxManage cloud <--provider=name> <--profile=name>
image info <--id=unique id>
```

Display information about a cloud image with a specified id.

--id
Unique identifier which fully identifies the image in the Cloud.

cloud image delete

```
VBoxManage cloud <--provider=name> <--profile=name>
image delete <--id=unique id>
```

Delete an image with a specified id from the Cloud.

--id
Unique identifier which fully identifies the image in the Cloud.

cloud image import

```
VBoxManage cloud <--provider=name> <--profile=name>
image import <--id=unique id> [--bucket-name=name] [--object-name=name]
```

Import an image with a specified id from the Cloud to a local host. The result is an object in the local "temp" folder on the local host. Possible approach may have two general steps: 1. Create an object from an image in the Cloud Storage; 2. Download the object to the local host. So the next parameters may be required: bucket-name - cloud bucket name where the object will be created; object-name - name of object in the bucket. if parameter "object-name" is absent a displayed image name is used. If the first step isn't needed only the parameter "id" is required.

--id
Unique identifier which fully identifies the image in the Cloud.

--bucket-name
Cloud bucket name where an object will be created.

--object-name
Name of created object in the bucket. The downloaded object will have this name.

cloud image export

```
VBoxManage cloud <--provider=name> <--profile=name>
image export <--id=unique id> <--display-name=name> [--bucket-name=name]
[--object-name=name]
```

Export an existing VBox image with a specified uuid from a local host to the Cloud. The result is new image in the Cloud. Possible approach may have two general steps: 1. Upload VBox image to the Cloud Storage; 2. Create an image from the uploaded object. So the next parameters may be required: bucket-name -cloud bucket name where the object will be uploaded; object-name - name of object in the bucket. If parameter "object-name" is absent the image id is used; display-name - name for new image in the Cloud. If the first step isn't needed the parameters "id" and "display-name" are required only.

--id
Unique identifier of the image in the VirtualBox.

--display-name
Name for new image in the Cloud.

--bucket-name
Cloud bucket name where the image (object) will be uploaded.

--object-name
Name of object in the bucket.

cloud network setup

```
VBoxManage cloud <--provider=name> <--profile=name>
network setup [--gateway-os-name=string] [--gateway-os-version=string]
[--gateway-shape=string] [--tunnel-network-name=string]
[--tunnel-network-range=string] [--proxy=string] [--compartment-id=string]
```

Set up a cloud network environment for the specified cloud profile.

--gateway-os-name
The name of OS to use for a cloud gateway.

--gateway-os-version
The version of OS to use for a cloud gateway.

--gateway-shape
The instance shape to use for a cloud gateway.

--tunnel-network-name
The name of VCN/subnet to use for tunneling.

--tunnel-network-range
The IP address range to use for tunneling.

--proxy
The proxy URL to be used in local gateway installation.

--compartment-id
The compartment to create the tunnel network in.

cloud network create

```
VBoxManage cloud <--provider=name> <--profile=name>
network create <--name=string> <--network-id=string> [--enable | --disable]
```

Create a new cloud network descriptor associated with an existing cloud subnet.

--name
The name to assign to the cloud network descriptor.

--network-id
The unique identifier of an existing subnet in the cloud.

--enable, --disable
Whether to enable the network descriptor or disable it. If not specified, the network will be enabled.

cloud network update

```
VBoxManage cloud network update <--name=string> [--network-id=string]
[--enable | --disable]
```

Modify an existing cloud network descriptor.

--name
The name of an existing cloud network descriptor.

--network-id
The unique identifier of an existing subnet in the cloud.

--enable, --disable
Whether to enable the network descriptor or disable it.

cloud network delete

```
VBoxManage cloud network delete <--name=string>
```

Delete an existing cloud network descriptor.

--name
The name of an existing cloud network descriptor.

cloud network info

```
VBoxManage cloud >network info <--name=string>
```

Display information about a cloud network descriptor.

--name
The name of an existing cloud network descriptor.

VBoxManage cloudprofile

Manage the cloud profiles

Synopsis

```
VBoxManage cloudprofile <--provider=name> <--profile=name> add
[--clouduser=unique id] [--fingerprint=MD5 string] [--keyfile=path]
[--passphrase=string] [--tenancy=unique id] [--compartment=unique id]
[--region=string]
```

```
VBoxManage cloudprofile <--provider=name> <--profile=name> update
[--clouduser=unique id] [--fingerprint=MD5 string] [--keyfile=path]
[--passphrase=string] [--tenancy=unique id] [--compartment=unique id]
[--region=string]
```

```
VBoxManage cloudprofile <--provider=name> <--profile=name> delete
```

```
VBoxManage cloudprofile <--provider=name> <--profile=name> show
```

Description

Common options

The subcommands of `cloudprofile` implement the standard CRUD operations for a cloud profile. The next common options must be placed between the "cloud" and the following sub-commands:

--provider=*name*
Short cloud provider name.

--profile=*name*
Cloud profile name.

cloudprofile add

```
VBoxManage cloudprofile <--provider=name> <--profile=name> add
[--clouduser=unique id] [--fingerprint=MD5 string] [--keyfile=path]
[--passphrase=string] [--tenancy=unique id] [--compartment=unique id]
[--region=string]
```

Add new cloud profile for a specified cloud provider.

`--clouduser=` *unique id*
The name which fully identifies the user in the specified cloud provider.

`--fingerprint=` *MD5 string*
Fingerprint for the key pair being used.

`--keyfile=` *path*
Full path and filename of the private key.

`--passphrase=` *string*
Passphrase used for the key, if it is encrypted.

`--tenancy=` *unique id*
ID of your tenancy.

`--compartment=` *unique id*
ID of your compartment.

`--region=` *string*
Region name. Region is where you plan to deploy an application.

cloudprofile show

```
VBoxManage cloudprofile <--provider=name> <--profile=name> show
```

Display information about a cloud profile for a specified cloud provider.

cloudprofile update

```
VBoxManage cloudprofile <--provider=name> <--profile=name> update
[--clouduser=unique id] [--fingerprint=MD5 string] [--keyfile=path]
[--passphrase=string] [--tenancy=unique id] [--compartment=unique id]
[--region=string]
```

Modify a cloud profile for the specified cloud provider.

`--clouduser=` *unique id*
The name which fully identifies the user in the specified cloud provider.

`--fingerprint=` *MD5 string*
Fingerprint for the key pair being used.

`--keyfile=` *path*
Full path and filename of the private key.

`--passphrase=` *string*
Passphrase used for the key, if it is encrypted.

`--tenancy=` *unique id*
ID of your tenancy.

`--compartment=` *unique id*
ID of your compartment.

`--region=` *string*
Region name. Region is where you plan to deploy an application.

cloudprofile delete

```
VBoxManage cloudprofile <--provider=name> <--profile=name> delete
```

Delete a cloud profile for a specified cloud provider.

VBoxManage controlvm

Change state and settings for a running virtual machine

Synopsis

```
VBoxManage controlvm <uuid | vmname> pause
```

```
VBoxManage controlvm <uuid | vmname> resume
```

```
VBoxManage controlvm <uuid | vmname> reset
```

```
VBoxManage controlvm <uuid | vmname> poweroff
```

```
VBoxManage controlvm <uuid | vmname> savestate
```

```
VBoxManage controlvm <uuid | vmname> acpipowerbutton
```

```
VBoxManage controlvm <uuid | vmname> acpisleepbutton
```

```
VBoxManage controlvm <uuid | vmname> reboot
```

```
VBoxManage controlvm <uuid | vmname> shutdown [--force]
```

```
VBoxManage controlvm <uuid | vmname> keyboardputscancode <hex> [hex...]
```

```
VBoxManage controlvm <uuid | vmname> keyboardputstring <string>
[string...]
```

```
VBoxManage controlvm <uuid | vmname> keyboardputfile <filename>
```

```
VBoxManage controlvm <uuid | vmname> setlinkstateN <on | off>
```

```
VBoxManage controlvm <uuid | vmname> nicN <null | nat | bridged |
intnet | hostonly | generic | natnetwork> [device-name]
```

```
VBoxManage controlvm <uuid | vmname> nictraceN <on | off>
```

```
VBoxManage controlvm <uuid | vmname> nictracefileN <filename>
```

```
VBoxManage controlvm <uuid | vmname> nicpropertyN <prop-name=prop-value>
```

```
VBoxManage controlvm <uuid | vmname> nicpromiscN <deny | allow-vms |
allow-all>
```

```
VBoxManage controlvm <uuid | vmname> natpfN <[rulename],<tcp|udp>,
[host-IP],hostport,[guest-IP],guestport>
```

```
VBoxManage controlvm <uuid | vmname> natpfNdelete <rulename>
```

```
VBoxManage controlvm <uuid | vmname> guestmemoryballoon <balloon-size>
```

```
VBoxManage controlvm <uuid | vmname> usbattach <uuid | address>
[--capturefile=filename]
```

```
VBoxManage controlvm <uuid | vmname> usbdetach <uuid | address>
```

```
VBoxManage controlvm <uuid | vmname> audioin <on | off>
```

```
VBoxManage controlvm <uuid | vmname> audioout <on | off>
```

```
VBoxManage controlvm <uuid | vmname> clipboard mode <disabled |
hosttoguest | guesttohost | bidirectional>
```

```
VBoxManage controlvm <uuid | vmname> clipboard filetransfers <on | off>
```

```
VBoxManage controlvm <uuid | vmname> draganddrop <disabled |
hosttoguest | guesttohost | bidirectional>
```

```
VBoxManage controlvm <uuid | vmname> vrde <on | off>
```

```
VBoxManage controlvm <uuid | vmname> vrdeport <port>
```

```
VBoxManage controlvm <uuid | vmname> vrdeproperty <prop-name=prop-value>
```

```
VBoxManage controlvm <uuid | vmname> vrdevideochannelquality
<percentage>
```

```
VBoxManage controlvm <uuid | vmname> setvideomodehint <xres> <yres> <bpp>
[display [ <yes | no> [ x-origin y-origin]]]
```

```
VBoxManage controlvm <uuid | vmname> setscreenlayout <display> <on |
primary x-origin y-origin x-resolution y-resolution bpp | off>
```

```
VBoxManage controlvm <uuid | vmname> screenshotpng <filename> [display]
```

```
VBoxManage controlvm <uuid | vmname> recording <on | off>
```

```
VBoxManage controlvm <uuid | vmname> recording screens <all | none |
screen-ID ,screen-ID...>
```

```
VBoxManage controlvm <uuid | vmname> recording filename <filename>
```

```
VBoxManage controlvm <uuid | vmname> recording videores <<width>x
<height>>
```

```
VBoxManage controlvm <uuid | vmname> recording videorate <rate>
```

```
VBoxManage controlvm <uuid | vmname> recording videofps <fps>
```

```
VBoxManage controlvm <uuid | vmname> recording maxtime <sec>
```

```
VBoxManage controlvm <uuid | vmname> recording maxfilesize <MB>
```

```
VBoxManage controlvm <uuid | vmname> setcredentials <username>
--passwordfile=<filename | password> <domain-name> --allowlocallogon=<yes |
no>
```

```
VBoxManage controlvm <uuid | vmname> teleport <--host=host-name>
<--port=port-name> [--maxdowntime=msec] [--passwordfile=filename |
--password=password]
```

```
VBoxManage controlvm <uuid | vmname> plugcpu <ID>
```

```
VBoxManage controlvm <uuid | vmname> unplugcpu <ID>
```

```
VBoxManage controlvm <uuid | vmname> cpuexecutioncap <num>
```

```
VBoxManage controlvm <uuid | vmname> vm-process-priority <default |
flat | low | normal | high>
```

```
VBoxManage controlvm <uuid | vmname> webcam attach [pathname [settings]]
```

```
VBoxManage controlvm <uuid | vmname> webcam detach [pathname]
```

```
VBoxManage controlvm <uuid | vmname> webcam list
```

```
VBoxManage controlvm <uuid | vmname> addencpassword <ID> <password-file |
-> [--removeonsuspend=yes | no]
```

```
VBoxManage controlvm <uuid | vmname> removeencpassword <ID>
```

```
VBoxManage controlvm <uuid | vmname> removeallencpasswords
```

```
VBoxManage controlvm <uuid | vmname> changeuartmodeN disconnected |
server pipe-name | client pipe-name | tcpserver port | tcpclient
hostname:port | file filename | device-name
```

```
VBoxManage controlvm <uuid | vmname> autostart-enabledN on | off
```

```
VBoxManage controlvm <uuid | vmname> autostart-delay <seconds>
```

Description

The `VBoxManage controlvm` command enables you to change the state of a running virtual machine (VM). The following sections describe the subcommands that you can use:

Pause a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> pause
```

The `VBoxManage controlvm vmname pause` command temporarily stops the execution of a VM. When paused, the VM's state is not permanently changed.

The VM window appears as gray and the title bar of the window indicates that the VM is currently Paused. This action is equivalent to selecting *Pause* from the *Machine* menu of the GUI.

Resume a Paused Virtual Machine

```
VBoxManage controlvm <uuid | vmname> resume
```

The `VBoxManage controlvm vmname resume` command restarts the execution of a paused VM. This action is equivalent to selecting *Resume* from the *Machine* menu of the GUI.

Reset a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> reset
```

The `VBoxManage controlvm vmname reset` command performs a cold reset the VM. This command has the same effect on a VM as pressing the Reset button on a physical computer.

The cold reboot immediately restarts and reboots the guest operating system (OS). The state of the VM is not saved prior to the reset, so data might be lost. This action is equivalent to selecting *Reset* from the *Machine* menu of the GUI.

Power Off a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> poweroff
```

The `VBoxManage controlvm vmname poweroff` command powers off the VM. This command has the same effect on a VM as pulling the power cable on a physical computer.

The state of the VM is not saved prior to poweroff, so data might be lost. This action is equivalent to selecting *Close* from the *Machine* menu of the GUI or to clicking the VM window's Close button, and then selecting *Power Off the Machine*.

When in the powered off state, you can restart the VM. See VBoxManage startvm.

Save the State of a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> savestate
```

The `VBoxManage controlvm vmname savestate` command saves the current state of the VM to disk and then stops the VM.

This action is equivalent to selecting *Close* from the *Machine* menu of the GUI or to clicking the VM window's Close button, and then selecting *Save the Machine State*.

When in the saved state, you can restart the VM. It will continue exactly in the state you saved.

Send an APCI Shutdown Signal to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> acpipowerbutton
```

The `VBoxManage controlvm vmname acpipowerbutton` command sends an ACPI shutdown signal to the VM. This command has the same effect on a VM as pressing the Power button on a physical computer.

So long as the VM runs a guest OS that provides appropriately configured ACPI support, this command triggers an operating system shutdown from within the VM.

Send an APCI Sleep Signal to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> acpisleepbutton
```

The `VBoxManage controlvm vmname acpisleepbutton` command sends an ACPI sleep signal to the VM.

So long as the VM runs a guest OS that provides appropriately configured ACPI support, this command triggers a sleep mechanism from within the VM.

Reboot the guest OS

```
VBoxManage controlvm <uuid | vmname> reboot
```

The `VBoxManage controlvm vmname reboot` command asks the guest OS to reboot itself.

This commands requires Guest Additions to be installed in the VM.

Shut down the guest OS

```
VBoxManage controlvm <uuid | vmname> shutdown [--force]
```

The `VBoxManage controlvm vmname shutdown` command asks the guest OS to halt + shutdown, optionally forcing the shutdown.

This commands requires Guest Additions to be installed in the VM.

Send Keyboard Scancodes to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> keyboardputscancode <hex> [hex...]
```

The `VBoxManage controlvm vmname keyboardputscancode` command sends keyboard scancode commands to the VM.

For information about keyboard scancodes, see http://www.win.tue.nl/~aeb/linux/kbd/scancodes-1.html.

Send Keyboard Strings to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> keyboardputstring <string>
[string...]
```

The `VBoxManage controlvm vmname keyboardputstring` command sends keyboard strings to the VM.

Send a File to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> keyboardputfile <filename>
```

The `VBoxManage controlvm vmname keyboardputfile` command sends a file to the VM.

Set the Link State for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> setlinkstateN <on | off>
```

`VBoxManage controlvm` *`vmname`* `setlinkstate`*`N`* command enables you to connect or disconnect the virtual network cable from the network interface instance (*N*). Valid values are `on` and `off`. The default value is `on`.

Set the Type of Networking to Use for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> nicN <null | nat | bridged |
intnet | hostonly | generic | natnetwork> [device-name]
```

The `VBoxManage controlvm` *`vmname`* `nic`*`N`* command specifies the type of networking to use on the specified VM's virtual network card. *N* numbering begins with `1`.

The following valid network types are also described in Introduction to Networking Modes:

- `null` specifies that the VM is is not connected to the host system.
- `nat` specifies that the VM uses network address translation (NAT).
- `bridged` specifies that the VM uses bridged networking.
- `intnet` specifies that the VM communicates with other VMs by using internal networking.
- `hostonly` specifies that the VM uses host-only networking.
- `natnetwork` specifies that the VM uses NAT networking.
- `generic` specifies that the VM has access to rarely used submodes

Trace the Network Traffic of a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> nictraceN <on | off>
```

The `VBoxManage controlvm` *`vmname`* `nictrace`*`N`* command enables you to trace the network traffic on the specified virtual network card (*N*). *N* numbering begins with `1`. Valid values are `on` and `off`. The default value is `off`.

If you did not configure a file name for the trace file then a default one is used, placing it in the VM subdirectory.

Specify the Network Traffic Trace Log File for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> nictracefileN <filename>
```

The `VBoxManage controlvm` *`vmname`* `nictracefile`*`N`* command enables you to specify the name of the network traffic trace log file for the specified virtual network card (*N*). *N* numbering begins with `1`.

Specify the Promiscuous Mode to Use for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> nicpromiscN <deny | allow-vms |
allow-all>
```

The `VBoxManage controlvm vmname nicpromiscN` command enables you to specify how to handle promiscuous mode for a bridged network. The default value of `deny` hides any traffic that is not intended for this VM. The `allow-vms` value hides all host traffic from this VM but enables the VM to see traffic to and from other VMs. The `allow-all` value removes this restriction completely.

Specify the Network Backend Property Values for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> nicpropertyN <prop-name=prop-value>
```

The `VBoxManage controlvm vmname nicpropertyN prop-name=prop-value` command, in combination with `nicgenericdrv`, enables you to pass property values to rarely-used network backends.

Those properties are backend engine-specific, and are different between UDP Tunnel and the VDE backend drivers. See UDP Tunnel Networking.

Specify a NAT Port Forwarding Rule for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> natpfN <[rulename],<tcp|udp>,
[host-IP],hostport,[guest-IP],guestport>
```

The `VBoxManage controlvm vmname natpfN` command specifies a NAT port-forwarding rule. See Configuring Port Forwarding with NAT.

Delete a NAT Port Forwarding Rule for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> natpfNdelete <rulename>
```

The `VBoxManage controlvm vmname natpfN delete` command deletes the specified NAT port-forwarding rule. See Configuring Port Forwarding with NAT.

Change Size of a Virtual Machine's Guest Memory Balloon

```
VBoxManage controlvm <uuid | vmname> guestmemoryballoon <balloon-size>
```

The `VBoxManage controlvm vmname guestmemoryballoon` command changes the size of the guest memory balloon. The guest memory balloon is the memory allocated by the Oracle VM VirtualBox Guest Additions from the guest OS and returned to the hypervisor for reuse by other VMs. The value you specify is in megabytes. See Memory Ballooning.

Make a Host System USB Device Visible to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> usbattach <uuid | address>
[--capturefile=filename]
```

The `VBoxManage controlvm vmname usbattach` command dynamically attaches a host USB device to the VM, which makes it visible. You do not need to create a filter.

Specify a USB device by its Universally Unique Identifier (UUID) or by its address on the host system. Use the `VBoxManage list usbhost` command to obtain information about USB devices on the host system.

Use the `--capturefile` option to specify the absolute path of a file in which to write logging data.

Make a Host System USB Device Invisible to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> usbdetach <uuid | address>
```

The `VBoxManage controlvm vmname usbdetach` command dynamically detaches a host USB device from the VM, which makes it invisible. You do not need to create a filter.

Specify a USB device by its UUID or by its address on the host system. Use the `VBoxManage list usbhost` command to obtain information about USB devices on the host system.

Enable or Disable Audio Capture From the Host System

```
VBoxManage controlvm <uuid | vmname> audioin <on | off>
```

The `VBoxManage controlvm vmname audioin` command specifies whether to enable or disable audio capture from the host system. Valid values are `on`, which enables audio capture and `off`, which disables audio capture. The default value is `off`.

Enable or Disable Audio Playback From a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> audioout <on | off>
```

The `VBoxManage controlvm vmname audioout` command specifies whether to enable or disable audio playback from the guest VM. Valid values are `on`, which enables audio playback and `off`, which disables audio playback. The default value is `off`.

Specify How to Share the Host OS or Guest OS Clipboard

```
VBoxManage controlvm <uuid | vmname> clipboard mode <disabled |
hosttoguest | guesttohost | bidirectional>
```

The `VBoxManage controlvm vmname clipboard mode` command specifies how to share the guest or host OS's clipboard with the host system or VM. Valid values are `disabled`, `hosttoguest`, `guesttohost`, and `bidirectional`. The default value is `disabled`. See General Settings.

This feature requires that the Oracle VM VirtualBox Guest Additions are installed in the VM.

Specify If Files Can Be Transferred Through the Clipboard

```
VBoxManage controlvm <uuid | vmname> clipboard filetransfers <on | off>
```

The `VBoxManage controlvm vmname clipboard filetransfers` command specifies if it is possible to transfer files through the clipboard between the host and VM, in the direction which is allowed. Valid values are `off` and `on`. The default value is `off`.

This feature requires that the Oracle VM VirtualBox Guest Additions are installed in the VM.

Set the Drag and Drop Mode Between the Host System and a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> draganddrop <disabled |
hosttoguest | guesttohost | bidirectional>
```

The `VBoxManage controlvm vmname draganddrop` command specifies the current drag and drop mode to use between the host system and the VM. Valid values are `disabled`, `hosttoguest`, `guesttohost`, and `bidirectional`. The default value is `disabled`. See Drag and Drop.

This feature requires that the Oracle VM VirtualBox Guest Additions are installed in the VM.

Enable or Disable the VRDE Server

```
VBoxManage controlvm <uuid | vmname> vrde <on | off>
```

The `VBoxManage controlvm vmname vrde` command enables or disables the VirtualBox Remote Desktop Extension (VRDE) server, if installed. Valid values are `on` and `off`. The default value is `off`.

Specify VRDE Server Ports

```
VBoxManage controlvm <uuid | vmname> vrdeport <port>
```

The `VBoxManage controlvm vmname vrdeport` command specifies the port or range of ports to which the VRDE server can bind. The default value is `default` or `0`, which is the standard RDP port, `3389`.

Also see the `--vrde-port` option description in Remote Machine Settings.

Specify VRDE Server Port Numbers and IP Addresses

```
VBoxManage controlvm <uuid | vmname> vrdeproperty <prop-name=prop-value>
```

The `VBoxManage controlvm vmname vrdeproperty` command specifies the port numbers and IP address on the VM to which the VRDE server can bind.

- `TCP/Ports` specifies a port or a range of ports to which the VRDE server can bind. The default value is `default` or `0`, which is the standard RDP port, `3389`.

  Also see the `--vrde-port` option description in Remote Machine Settings.

- `TCP/Address` specifies the IP address of the host network interface to which the VRDE server binds. When specified, the server accepts to connect only on the specified host network interface.

  Also see the `--vrde-address` option description in Remote Machine Settings.

- `VideoChannel/Enabled` specifies whether to enable the VirtualBox Remote Desktop Protocol (VRDP) video channel. Valid values are `1` to enable the video channel and `0` to disable the video channel. The default value is `off`. See VRDP Video Redirection.

- `VideoChannel/Quality` specifies the JPEG compression level on the VRDE server video channel. Valid values are between 10% and 100%, inclusive. Lower values mean lower quality but higher compression. The default value is `100`. See VRDP Video Redirection.

- `VideoChannel/DownscaleProtection` specifies whether to enable the video channel downscale protection feature. Specify `1` to enable the feature. This feature is disabled by default.

  When enabled, if the video's size equals the shadow buffer size, the video is shown in full-screen mode. If the video's size is between full-screen mode and the downscale threshold, the video is not shown as it might be an application window that is unreadable when downscaled. When disabled, the downscale protection feature always attempts to show videos.

- `Client/DisableDisplay` specifies whether to disable the VRDE server display feature. Valid values are `1` to disable the feature and an empty string (`""`) to enable the feature. The default value is an empty string. See VRDP Customization.

- `Client/DisableInput` specifies whether to disable the VRDE server input feature. Valid values are `1` to disable the feature and an empty string (`""`) to enable the feature. The default value is `1`. See VRDP Customization.
- `Client/DisableAudio` specifies whether to disable the VRDE server audio feature. Valid values are `1` to disable the feature and an empty string (`""`) to enable the feature. The default value is `1`. See VRDP Customization.
- `Client/DisableUSB` specifies whether to disable the VRDE server USB feature. Valid values are `1` to disable the feature and an empty string (`""`) to enable the feature. The default value is `1`. See VRDP Customization.
- `Client/DisableClipboard` specifies whether to disable the VRDE clipboard feature. Valid values are `1` to disable the feature and an empty string (`""`) to enable the feature. To reenable the feature, use `Client/DisableClipboard=`. The default value is `1`. See VRDP Customization.
- `Client/DisableUpstreamAudio` specifies whether to disable the VRDE upstream audio feature. Valid values are `1` to disable the feature and an empty string (`""`) to enable the feature. To reenable the feature, use `Client/DisableUpstreamAudio=`. The default value is `1`. See VRDP Customization.
- `Client/DisableRDPDR` specifies whether to disable the RDP Device Redirection For Smart Cards feature on the VRDE server. Valid values are `1` to disable the feature and an empty string (`""`) to enable the feature. The default value is `1`. See VRDP Customization.
- `H3DRedirect/Enabled` specifies whether to enable the VRDE server 3D redirection feature. Valid values are `1` to enable the feature and an empty string (`""`) to disable the feature. See VRDP Customization.
- `Security/Method` specifies the security method to use for a connection. See RDP Encryption.
  - `Negotiate` accepts both enhanced (TLS) and standard RDP security connections. The security method is negotiated with the client. This is the default value.
  - `RDP` accepts only standard RDP security connections.
  - `TLS` accepts only enhanced RDP security connections. The client must support TLS.
- `Security/ServerCertificate` specifies the absolute path of the server certificate to use for a connection. See RDP Encryption.
- `Security/ServerPrivateKey` specifies the absolute path of the server private key. See RDP Encryption.
- `Security/CACertificate` specifies the absolute path of the CA self-signed certificate. See RDP Encryption.
- `Audio/RateCorrectionMode` specifies the rate correction mode to use.
  - `VRDP_AUDIO_MODE_VOID` indicates that no mode is specified. Use this value to unset any audio mode that is already set.
  - `VRDP_AUDIO_MODE_RC` specifies to use the rate correction mode.
  - `VRDP_AUDIO_MODE_LPF` specifies to use the low pass filter mode.
  - `VRDP_AUDIO_MODE_CS` specifies to use the client sync mode to prevent underflow or overflow of the client queue.
- `Audio/LogPath` specifies the absolute path of the audio log file.

Specify the Image Quality for VRDP Video Redirection

```
VBoxManage controlvm <uuid | vmname> vrdevideochannelquality
<percentage>
```

The `VBoxManage controlvm vmname vrdevideochannelquality` command sets the image quality, as a JPEG compression level value, for video redirection. Valid values are between 10% and 100%, inclusive. Lower values mean lower quality but higher compression. See VRDP Video Redirection.

Specify the Video Mode for the Guest VM

```
VBoxManage controlvm <uuid | vmname> setvideomodehint <xres> <yres> <bpp>
[display [ <yes | no> [ x-origin y-origin]]]
```

The `VBoxManage controlvm vmname setvideomodehint` command specifies the video mode for the guest VM to use. You must have the Oracle VM VirtualBox Guest Additions installed. Note that this feature does not work for all guest systems.

Specify the Screen Layout for a Display on the Guest VM

```
VBoxManage controlvm <uuid | vmname> setscreenlayout <display> <on |
primary x-origin y-origin x-resolution y-resolution bpp | off>
```

The `VBoxManage controlvm vmname setscreenlayout` command can be used to configure multiscreen displays. The specified screen on the guest VM can be enabled or disabled, or a custom screen layout can be configured.

Take a Screen Shot of the Virtual Machine Display

```
VBoxManage controlvm <uuid | vmname> screenshotpng <filename> [display]
```

The `VBoxManage controlvm vmname screenshotpng` command takes a screenshot of the guest display and saves it as PNG in the specified file.

- *filename* specifies the name of the PNG file to create.
- *display* specifies the display number for the screen shot. For a single monitor guest display, this is `0`.

Enable or Disable the Recording of a Virtual Machine Session

```
VBoxManage controlvm <uuid | vmname> recording <on | off>
```

The `VBoxManage controlvm vmname recording` command enables or disables the recording of a VM session into a WebM/VP8 file. Valid values are `on`, which begins recording when the VM session starts and `off`, which disables recording. The default value is `off`.

Specify the Virtual Machine Screens to Record

```
VBoxManage controlvm <uuid | vmname> recording screens <all | none |
screen-ID ,screen-ID...>
```

The `VBoxManage controlvm vmname recording screens` command enables you to specify which VM screens to record. The recording for each screen that you specify is saved to its own file in the machine folder. You cannot modify this setting while recording is enabled.

- `all` specifies that you record all VM screens.
- `none` specifies that you do not record any VM screens.
- *screen-ID* specifies one or more VM screens to record.

Specify the File in Which to Save Virtual Machine Recording

```
VBoxManage controlvm <uuid | vmname> recording filename <filename>
```

The `VBoxManage controlvm vmname recording filename` command specifies the file in which to save the recording. You cannot modify this setting while recording is enabled.

The default setting is to store a recording in the machine folder, using the VM name as the file name, with a `webm` file name extension.

Specify the Resolution of the Recorded Video

```
VBoxManage controlvm <uuid | vmname> recording videores <<width>x
<height>>
```

`VBoxManage controlvm vmname recording videores` command specifies the resolution of the recorded video in pixels. You cannot modify this setting while recording is enabled.

Use the Settings tool to view the video recording settings, which are based on the resolution (frame size). See the Frame Size field on the Recording tab of the Display page to view the default value.

Specify the resolution as *width*x*height*:

- *width* specifies the width in pixels.
- *height* specifies the height in pixels.

Specify the Bit Rate of the Video

```
VBoxManage controlvm <uuid | vmname> recording videorate <rate>
```

The `VBoxManage controlvm vmname recording videorate` command specifies the bit rate, *bit-rate*, of the video in kilobits per second. Increasing this value improves the appearance of the video at the cost of an increased file size. You cannot modify this setting while recording is enabled.

Use the Settings tool to view the video recording settings, which are based on the frame size. See the Video Quality field on the Recording tab of the Display page to view the default value.

Specify the Maximum Frequency of the Video

```
VBoxManage controlvm <uuid | vmname> recording videofps <fps>
```

The `VBoxManage controlvm vmname recording videofps` command specifies the maximum frequency of the video to record. Video frequency is measured in frames per second (FPS). The recording skips any frames that have a frequency higher than the specified maximum. Increasing the frequency reduces the number of skipped frames and increases the file size. You cannot modify this setting while recording is enabled.

Use the Settings tool to view the video recording settings, which are based on the frame size. See the Frame Rate field on the Recording tab of the Display page to view the default value.

Specify the Maximum Amount of Time to Record Video

```
VBoxManage controlvm <uuid | vmname> recording maxtime <sec>
```

The `VBoxManage controlvm vmname recording maxtime` command specifies the maximum amount time to record in seconds. The recording stops after the specified number of seconds elapses. If this value is zero, the recording continues until you stop the recording.

Specify the Maximum Size of the Recorded Video

```
VBoxManage controlvm <uuid | vmname> recording maxfilesize <MB>
```

The `VBoxManage controlvm vmname recording maxfilesize` command specifies the maximum size of the recorded video file in megabytes. The recording stops when the file reaches the specified size. If this value is zero, the recording continues until you stop the recording. You cannot modify this setting while recording is enabled.

Specify Credentials for Remote Logins on Windows Virtual Machines

```
VBoxManage controlvm <uuid | vmname> setcredentials <username>
--passwordfile=<filename | password> <domain-name> --allowlocallogon=<yes |
no>
```

The `setcredentials` command enables you to specify the credentials for remotely logging in to Windows VMs. See Automated Guest Logins.

- *username* specifies the user name with which to log in to the Windows VM.
- `--passwordfile=`*filename* specifies the file from which to obtain the password for *username*.

  The `--passwordfile` is mutually exclusive with the `--password` option.
- `--password=`*password* specifies the password for *username*.

  The `--password` is mutually exclusive with the `--passwordfile` option.
- `--allowlocallogin` specifies whether to enable or disable local logins. Valid values are `on` to enable local logins and `off` to disable local logins.

Configure a Virtual Machine Target for Teleporting

```
VBoxManage controlvm <uuid | vmname> teleport <--host=host-name>
<--port=port-name> [--maxdowntime=msec] [--passwordfile=filename |
--password=password]
```

The `VBoxManage controlvm vmname teleport` command initiates a teleporting operation between the specified VM and the specified host system. See Teleporting.

If you specify a password, it must match the password you specified when you issued the `VBoxManage modifyvm` command for the target machine.

`--host=` *hostname*
Specifies the name of the VM.

`--port=` *port*
Specifies the port on the VM that should listen for a teleporting request from other VMs. The port number can be any free TCP/IP port number, such as `6000`.

`--maxdowntime=` *msec*
Specifies the maximum downtime, in milliseconds, for the teleporting target VM.

`--password=` *password*
Specifies the password that the source machine uses for the teleporting request. The request succeeds only if the source machine specifies the same password.
The `--password` is mutually exclusive with the `--passwordfile` option.

`--passwordfile=` *filename*
Specifies the file from which to obtain the password that the source machine uses for the teleporting request. The request succeeds only if the source machine specifies the same password.
When you specify a file name of `stdin`, you can read the password from standard input.
The `--passwordfile` is mutually exclusive with the `--password` option.

Add a Virtual CPU to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> plugcpu <ID>
```

The `VBoxManage controlvm` *`vmname`* `plugcpu` command adds a virtual CPU to the specified VM if CPU hot-plugging is enabled. *ID* specifies the index of the virtual CPU to be added and must be a number from 0 to the maximum number of CPUs configured.

Remove a Virtual CPU From a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> unplugcpu <ID>
```

The `VBoxManage controlvm` *`vmname`* `unplugcpu` command removes a virtual CPU from the specified VM if CPU hot-plugging is enabled. *ID* specifies the index of the virtual CPU to be removed and must be a number from 0 to the maximum number of CPUs configured. You cannot remove CPU 0.

Set the Maximum Amount of Physical CPU Time Used by a Virtual CPU

```
VBoxManage controlvm <uuid | vmname> cpuexecutioncap <num>
```

The `VBoxManage controlvm` *`vmname`* `cpuexecutioncap` command specifies how the maximum amount of physical CPU time used by a virtual CPU. Valid values are a percentage between `1` and `100`. A value of `50` specifies that a single virtual CPU can use up to 50% of a physical CPU. The default value is `100`.

Use this feature with caution, it can have unexpected results including timekeeping problems and lower performance than specified. If you want to limit the resource usage of a VM it is more reliable to pick an appropriate number of VCPUs.

Change the Priority of a VM Process

```
VBoxManage controlvm <uuid | vmname> vm-process-priority <default |
flat | low | normal | high>
```

The `VBoxManage controlvm` *vmname* `vm-process-priority` command specifies the priority scheme of the VM process to use when starting the specified VM and while the VM runs.

Valid values are:

- `default` – Default process priority determined by the OS.
- `flat` – Assumes a scheduling policy which puts the process at the default priority and with all threads at the same priority.
- `low` – Assumes a scheduling policy which puts the process mostly below the default priority of the host OS.
- `normal` – Assume a scheduling policy which shares the CPU resources fairly with other processes running with the default priority of the host OS.
- `high` – Assumes a scheduling policy which puts the task above the default priority of the host OS. This policy might easily cause other tasks in the system to starve.

Attach a Webcam to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> webcam attach [pathname [settings]]
```

The `VBoxManage controlvm` *vmname* `webcam attach` command attaches a webcam to a running VM. Specify the webcam as the absolute path of the webcam on the host OS or as an alias. Use the `VBoxManage list webcams` command to obtain the webcam alias.

Note that the `.0` alias is the default video input device on the host OS. `.1` is the first video input device, `.2` is the second video input device, and so on. The order of the devices is specific to the host system.

You can specify optional settings in the form of semi-colon-separated (`;`) name-value pairs. These properties enable you to configure the emulated webcam device.

The following settings are supported:

`MaxFramerate`
Specifies the highest rate at which to send video frames to the VM. The rate is in frames per second. Higher frame rates increase CPU load, so you can use this setting to reduce CPU load. The default value is `no maximum limit`. This value enables the VM to use any frame rate supported by the webcam.

`MaxPayloadTransferSize`
Specifies the maximum number of bytes that the VM receives from the emulated webcam in one buffer. The default setting is `3060` bytes, which is used by some webcams. If the VM is

able to use larger buffers, higher values might reduce CPU load slightly. Note that some guest OSes might not suppport higher `MaxPayloadTransferSize` values.

Detach a Webcam From a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> webcam detach [pathname]
```

The `VBoxManage controlvm vmname webcam detach` command detaches a webcam from a running VM. Specify the webcam as the absolute path of the webcam on the host OS or as an alias. Use the `VBoxManage list webcams` to obtain the webcam alias.

When a webcam device is detached from the host, the host OS determines how the emulated webcam behaves.

- *Windows hosts:* The emulated webcam device is detached from the VM automatically.
- *Mac OS X hosts that run at least OS X 10.7:* The emulated webcam device remains attached to the VM and you must detach it manually by using the `VBoxManage controlvm webcam detach` command.
- *Linux hosts:* The emulated webcam device is detached from the VM automatically only if the webcam is actively streaming video. If the emulated webcam is inactive, manually detach it by using the `VBoxManage controlvm vmname webcam detach` command.

List the Webcams Attached to a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> webcam list
```

The `VBoxManage controlvm vmname webcam list` command lists webcams that are attached to the running VM. The output shows a list of absolute paths or aliases that attached the webcams to the VM by using the `VBoxManage controlvm vmname webcam attach` command.

Set an Encryption Password for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> addencpassword <ID> <password-file |
-> [--removeonsuspend=yes | no]
```

The `VBoxManage controlvm vmname addencpassword` command provides the *vmname* encrypted VM with the encryption password to enable a headless start. Specify the absolute path of a password file on the host system. If *filename* is `-`, `VBoxManage` prompts for the encryption password.

Use the `--removeonsuspend` option to specify whether to save the passsword or clear it from VM memory when the VM is suspended.

If the VM is suspended and the password is cleared, use the `VBoxManage controlvm vmname addencpassword` to provide the password to resume execution on the VM. Use this

feature when you do not want to store the password in VM memory while the VM is suspended by a host suspend event.

> **Note:**
>
> You can encrypt data stored on hard disk images used by the VM. Oracle VM VirtualBox uses the AES algorithm in XTS mode and supports 128-bit or 256-bit data encryption keys (DEK). The encrypted DEK is stored in the medium properties and is decrypted during VM startup when you provide the encryption password.

Use the `VBoxManage encryptmedium` command to create a DEK encrypted medium. See Encrypting Disk Images.

The Oracle VM VirtualBox GUI prompts you for the encryption password when you start an encrypted VM.

Use the following command to perform a headless start of an encrypted VM:

```
$ VBoxManage startvm vmname --type headless
```

Then, use the following command to provide the encryption password:

```
$ VBoxManage vmname controlvm addencpassword vmname -
Password: encryption-password
```

Disable an Encryption Password for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> removeencpassword <ID>
```

The `VBoxManage controlvm vmname removeencpassword` command disables a specific encryption password for all encrypted media attached to the VM.

ID is the password identifier for the encryption password that you want to disable.

Disable All Encryption Passwords for a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> removeallencpasswords
```

The `VBoxManage controlvm vmname removeallencpasswords` command disables all encryption passwords for all encrypted media attached to the VM.

Change the Connection Mode for a Virtual Serial Port on a Virtual Machine

```
VBoxManage controlvm <uuid | vmname> changeuartmodeN disconnected |
server pipe-name | client pipe-name | tcpserver port | tcpclient
hostname:port | file filename | device-name
```

The `VBoxManage controlvm vmname changeuartmode` command changes the connection mode for the specified virtual serial port. Valid serial port values are integers that start from `1`.

disconnected
Disconnects the device.

server *pipe-name*
Specifies the pipe name of the server.

client *pipe-name*
Specifies the pipe name of the client.

tcpserver *port*
Specifies the port number of the TCP server.

tcpclient *hostname*:*port*
Specifies the host name and port number of the TCP client.

file *filename*
Specifies the name of the file.

device-name
Specifies the name of the device.

Enabling autostart the VM during host system boot

```
VBoxManage controlvm <uuid | vmname> autostart-enabledN on | off
```

The `VBoxManage controlvm vmname autostart-enabled` command specifies whether to enable or disable automatically start the VM at host system boot-up. You must do some host system configuration before you can use this feature. See Starting Virtual Machines During System Boot. Valid values are `on`, which enables autostart feature for the VM and `off`, which disables it. The default value is `off`.

Setting the delay of starting the VM on host system boot

```
VBoxManage controlvm <uuid | vmname> autostart-delay <seconds>
```

The `VBoxManage controlvm` *`vmname`* `autostart-delay` command specifies the delay in seconds before the VM starts on host system boot-up. See Starting Virtual Machines During System Boot.

Examples

The following command temporarily stops the execution of the `ol7` VM.

```
$ VBoxManage controlvm ol7 pause
```

The following command configures shared clipboard operation for the `ol7` VM. Copying of clipboard data is allowed in both directions between the host and guest.

```
$ VBoxManage controlvm ol7 clipboard mode bidirectional
```

See Also

VBoxManage list, VBoxManage modifyvm, VBoxManage startvm

VBoxManage convertfromraw

Convert a raw disk image to a virtual disk image

Synopsis

```
VBoxManage convertfromraw <inputfile> <outputfile> [--format=VDI | VMDK |
VHD] [--uuid=uuid] [--variant=Standard|Fixed|Split2G|Stream|ESX...]
```

```
VBoxManage convertfromraw stdin <outputfile> <bytes> [--format=VDI | VMDK |
VHD] [--uuid=uuid] [--variant=Standard|Fixed|Split2G|Stream|ESX...]
```

Description

The `VBoxManage convertfromraw` command enables you to convert a raw disk image to an Oracle VM VirtualBox virtual disk image (VDI).

> **Note:**
>
> For compatibility with earlier versions of Oracle VM VirtualBox, you can use the `VBoxManage convertdd` command instead of the `VBoxManage convertfromraw` command.

Convert a Raw Disk File to a Virtual Disk Image File

```
VBoxManage convertfromraw <inputfile> <outputfile> [--format=VDI | VMDK |
VHD] [--uuid=uuid] [--variant=Standard|Fixed|Split2G|Stream|ESX...]
```

The `VBoxManage convertfromraw` command converts the specified raw disk image input file to an Oracle VM VirtualBox VDI file.

inputfile
Specifies the name of the raw disk image file to convert.

outputfile
Specifies the name of the file in which to write the VDI output.

`--format=VDI | VMDK | VHD`
Specifies the format of the disk image to create. Valid values are `VDI`, `VMDK`, and `VHD`. The default format is `VDI`.

`--uuid=` ***uuid***
Specifies the Universally Unique Identifier (UUID) of the output file.

`--variant=Standard | Fixed | Split2G | Stream | ESX[,...]`
Specifies any required file format variants for the output file. This is a comma-separated list of variant values. Following are the valid values:

- `Standard` is the default disk image type, which has a dynamically allocated file size.
- `Fixed` uses a disk image that has a fixed file size.
- `Split2G` indicates that the disk image is split into 2GB segments. This value is for VMDK only.
- `Stream` optimizes the disk image for downloading. This value is for VMDK only.
- `ESX` is used for some VMWare products. This value is for VMDK only.

Note that not all variant combinations are valid. Specifying incompatible variant values in the list will produce an error message.

Convert Raw Data From Standard Input to a Virtual Disk Image File

```
VBoxManage convertfromraw stdin <outputfile> <bytes> [--format=VDI | VMDK |
VHD] [--uuid=uuid] [--variant=Standard|Fixed|Split2G|Stream|ESX...]
```

The `VBoxManage convertfromraw stdin` command reads the content of the disk image from standard input. Consider using this form of the command in a pipe sequence.

outputfile
Specifies the name of the file in which to write the disk image output.

bytes
Specifies the capacity of the targe image name. Needs to be given explicitly, because generally pipes do not support querying the overall size of the data stream.

`--format=VDI | VMDK | VHD`
Specifies the format of the disk image to create. Valid values are `VDI`, `VMDK`, and `VHD`. The default format is `VDI`.

`--uuid=`*uuid*
Specifies the UUID of the output file.

`--variant=Standard,Fixed,Split2G,Stream,ESX`
Specifies any required file format variants for the output file. This is a comma-separated list of variant values. Following are the valid values:

- `Standard` is the default disk image type, which has a dynamically allocated file size.
- `Fixed` uses a disk image that has a fixed file size.
- `Split2G` indicates that the disk image is split into 2GB segments. This value is for VMDK only.
- `Stream` optimizes the disk image for downloading. This value is for VMDK only.
- `ESX` is used for some VMWare products. This value is for VMDK only.

Note that not all variant combinations are valid. Specifying incompatible variant values in the list will produce an error message.

Examples

The following command converts the raw disk image input file `disk01.raw`. The output file is a VDI disk image called `disk02.vdi`.

```
$ VBoxManage convertfromraw disk01.raw disk02.vdi
```

The following command converts the raw disk image input file `disk01.raw`. The output file is a VMDK disk image called `disk02.vmdk`.

```
$ VBoxManage convertfromraw disk01.raw disk02.vmdk --format VMDK
```

The following command reads from disk `/dev/sda` using a pipe and therefore needs the exact disk size in bytes as an additional parameter, which is assumed to be `10737418240`. The output file is a VDI disk image called `disk.vdi`.

```
$ dd if=/dev/sda bs=512 | VBoxManage convertfromraw stdin disk.vdi 10737418240
```

VBoxManage createmedium

Create a new medium

Synopsis

```
VBoxManage createmedium [disk | dvd | floppy] <--filename=filename>
[--size=megabytes | --sizebyte=bytes] [--diffparent=UUID | filename]
[--format=VDI | VMDK | VHD] [--variant=Standard|Fixed|Split2G|Stream|
ESX|Formatted|RawDisk...] [--property=name=value...]
[--property-file=name=/path/to/file/with/value...]
```

Description

The `VBoxManage createmedium` command creates a new medium, such as a disk image file.

> **Note:**
>
> For compatibility with earlier versions of Oracle VM VirtualBox, you can use the `createvdi` and `createhd` commands instead of the `createmedium` command.

disk | dvd | floppy
Specifies the media type. The default value is `disk`.

`--filename=` *filename*
Specifies the absolute path name to a file on the host file system.

`--size=` *megabytes*
Specifies the image capacity in one megabyte units.

`--sizebyte=` *bytes*
Specifies the image capacity in one byte units.

`--diffparent=` *UUID* | *filename*
Specifies the Universally Unique Identifier (UUID) or absolute path name of a differencing image parent file on the host file system.
Use this file to share a base box disk image among VMs.

`--format=VDI | VMDK | VHD`
Specifies the file format of the output file. Valid formats are `VDI`, `VMDK`, and `VHD`. The default format is `VDI`.

`--variant=Standard | Fixed | Split2G | Stream | ESX | Formatted | RawDisk [,...]`
Specifies the file format variant for the target medium, which is a comma-separated list of variants. Following are the valid values:

- `Standard` is the default disk image type, which has a dynamically allocated file size.
- `Fixed` uses a disk image that has a fixed file size.
- `Split2G` indicates that the disk image is split into 2GB segments. This value is valid for VMDK disk images only.
- `Stream` optimizes the disk image for downloading. This value is valid for VMDK disk images only.
- `ESX` is used for some VMWare products. This value is valid for VMDK disk images only.
- `Formatted` formats the medium automatically. This value is valid for floppy images only.
- `RawDisk` is used for creating a VMDK image which provides direct access to the hard disk on the host using its raw interface. This value is valid for VMDK disk images only. For detailed information about raw disk access, see Advanced Storage Configuration.

Note that not all variant combinations are valid. Specifying incompatible variant values in the list will produce an error message.

`--property=` *name = value*
Specifies any required file format dependent parameters in `key=value` form. Optional.

`--property-file=` *name = /path/to/file/with/value*
Specifies any required file format dependent parameters in `key=file/with/value` form. The value is taken from the file. Optional.

Examples

The following command creates a new disk image file named `disk01.vdi`. The file size is 1024 megabytes.

```
$ VBoxManage createmedium --filename disk01.vdi --size 1024
```

The following command creates a new floppy disk image file named `floppy01.vdi`. The file size is 1 megabyte.

```
$ VBoxManage createmedium floppy --filename floppy01.img --size 1
```

The following command creates a raw disk image of an entire physical disk on a Linux host.

```
$ VBoxManage createmedium disk --filename=/path/to/rawdisk.vmdk --variant=RawDisk --
format=VMDK --property RawDrive=/dev/sda
```

VBoxManage createvm

Create a new virtual machine

Synopsis

```
VBoxManage createvm <--name=name> [--basefolder=basefolder] [--default]
[--groups=group-ID [,...]] [--ostype=ostype] [--register] [--uuid=uuid]
[--cipher=cipher] [--password-id=password-id] [--password=file]
```

Description

The `VBoxManage createvm` command creates a new XML virtual machine (VM) definition file.

You must specify the name of the VM by using `--name` *name*. This name is used by default as the name of the settings file that has the `.vbox` extension and the machine folder, which is a subfolder of the `$HOME/VirtualBox VMs` directory.

The actual file name may not correspond directly to the VM name if it violates the host OS file name requirements (such as using the path separator or other reserved characters, they will be substituted with a placeholder). If you later rename the VM, the file and folder names will be updated to match the new name automatically.

Command Options

In addition to specifying the name or UUID of the VM, which is required, you can specify any of the following options:

`--basefolder=` *basefolder*
Specifies the name of the folder in which to save the machine configuration file for the new VM.
Note that the names of the file and the folder do not change if you rename the VM.

`--default`
Applies a default hardware configuration for the specified guest OS. By default, the VM is created with minimal hardware.

`--groups=` *group-ID* `[,...]`
Assigns the VM to the specified groups. If you specify more than one group, separate each group name with a comma.
Note that each group is identified by a group ID that starts with a slash character (`/`) so that groups can be nested. By default, a VM is always assigned membership to the `/` group.

`--ostype=` *ostype*
Specifies the guest OS to run in the VM. Run the `VBoxManage list ostypes` command to see the available OS types.

`--register`
Registers the VM with your Oracle VM VirtualBox installation. By default, the `VBoxManage createvm` command creates only the XML configuration for the VM but does not register the VM. If you do not register the VM at creation, you can run the `VBoxManage registervm` command after you create the VM.

`--uuid=` *uuid*
Specifies the Universally Unique Identifier (UUID) of the VM. Ensure that this UUID is unique within the Oracle VM VirtualBox namespace of the host or of its VM group memberships if you decide to register the VM. By default, Oracle VM VirtualBox provides the UUID.

`--cipher=` *cipher*
Specifies the cipher to use for encryption. Valid values are `AES-128` or `AES-256`.
This option enables you to set up encryption on VM.

`--password-id=` *password-id*
Specifies a new password identifier that is used for correct identification when supplying multiple passwords for the VM.
This option enables you to set up encryption on VM.

`--password=` *file*
Use the `--password` to supply the encryption password of the VM. Either specify the absolute pathname of a password file on the host operating system, or `-` to prompt you for the password on the command line.
This option enables you to set up encryption on VM.

Examples

The following command creates a VM called `vm2` where you plan to run a 64-bit version of Oracle Linux.

```
$ VBoxManage createvm --name "vm2" --ostype "Oracle_64"
```

The following command creates and registers a VM called `vm3`.

```
$ VBoxManage createvm --name "vm3" --register
```

See Also

VBoxManage list, VBoxManage registervm

VBoxManage debugvm

Introspection and guest debugging

Synopsis

```
VBoxManage debugvm <uuid | vmname> dumpvmcore [--filename=name]
```

```
VBoxManage debugvm <uuid | vmname> info <item> [args...]
```

```
VBoxManage debugvm <uuid | vmname> injectnmi
```

```
VBoxManage debugvm <uuid | vmname> log [--release | --debug]
[group-settings...]
```

```
VBoxManage debugvm <uuid | vmname> logdest [--release | --debug]
[destinations...]
```

```
VBoxManage debugvm <uuid | vmname> logflags [--release | --debug]
[flags...]
```

```
VBoxManage debugvm <uuid | vmname> osdetect
```

```
VBoxManage debugvm <uuid | vmname> osinfo

VBoxManage debugvm <uuid | vmname> osdmesg [--lines=lines]

VBoxManage debugvm <uuid | vmname> getregisters [--cpu=id]
[reg-set.reg-name...]

VBoxManage debugvm <uuid | vmname> setregisters [--cpu=id]
[reg-set.reg-name=value...]

VBoxManage debugvm <uuid | vmname> show [--human-readable | --sh-export |
--sh-eval | --cmd-set] [settings-item...]

VBoxManage debugvm <uuid | vmname> stack [--cpu=id]

VBoxManage debugvm <uuid | vmname> statistics [--reset] [--descriptions]
[--pattern=pattern]

VBoxManage debugvm <uuid | vmname> guestsample [--filename=filename]
[--sample-interval-us=interval] [--sample-time-us=time]
```

Description

The "debugvm" commands are for experts who want to tinker with the exact details of virtual machine execution. Like the VM debugger described in The Built-In VM Debugger, these commands are only useful if you are very familiar with the details of the PC architecture and how to debug software.

Common options

The subcommands of `debugvm` all operate on a running virtual machine:

uuid* | *vmname
Either the UUID or the name (case sensitive) of a VM.

debugvm dumpvmcore

```
VBoxManage debugvm <uuid | vmname> dumpvmcore [--filename=name]
```

Creates a system dump file of the specified VM. This file will have the standard ELF core format (with custom sections); see VM Core Format.

This corresponds to the `writecore` command in the debugger.

`--filename=` *filename*
The name of the output file.

debugvm info

```
VBoxManage debugvm <uuid | vmname> info <item> [args...]
```

Displays info items relating to the VMM, device emulations and associated drivers.

This corresponds to the `info` command in the debugger.

item
Name of the info item to display. The special name `help` will list all the available info items and hints about optional arguments.

args
Optional argument string for the info item handler. Most info items does not take any extra arguments. Arguments not recognized are generally ignored.

debugvm injectnmi

```
VBoxManage debugvm <uuid | vmname> injectnmi
```

Causes a non-maskable interrupt (NMI) to be injected into the guest. This might be useful for certain debugging scenarios. What happens exactly is dependent on the guest operating system, but an NMI can crash the whole guest operating system. Do not use unless you know what you're doing.

debugvm log

```
VBoxManage debugvm <uuid | vmname> log [--release | --debug]
[group-settings...]
```

Changes the group settings for either debug (`--debug`) or release (`--release`) logger of the VM process.

The *group-settings* are typically strings on the form `em.e.f.l`, `hm=~0` and `-em.f`. Basic wildcards are supported for group matching. The `all` group is an alias for all the groups.

Please do keep in mind that the group settings are applied as modifications to the current ones.

This corresponds to the `log` command in the debugger.

debugvm logdest

```
VBoxManage debugvm <uuid | vmname> logdest [--release | --debug]
[destinations...]
```

Changes the destination settings for either debug (`--debug`) or release (`--release`) logger of the VM process. For details on the destination format, the best source is src/VBox/Runtime/common/log/log.cpp.

The *destinations* is one or more mnemonics, optionally prefixed by "no" to disable them. Some of them take values after a ":" or "=" separator. Multiple mnemonics can be separated by space or given as separate arguments on the command line.

List of available destination:

`file[=`*file*`], nofile`
Specifies a log file. If no filename is given, one will be generated based on the current UTC time and VM process name and placed in the current directory of the VM process. Note that this will currently not have any effect if the log file has already been opened.

`dir=`*directory*`, nodir`
Specifies the output directory for log files. Note that this will currently not have any effect if the log file has already been opened.

`history=`*count*`, nohistory`
A non-zero value enables log historization, with the value specifying how many old log files to keep.

`histsize=`*bytes*
The max size of a log file before it is historized. Default is infinite.

`histtime=`*seconds*
The max age (in seconds) of a log file before it is historized. Default is infinite.

`ringbuffer, noringbuffer`
Only log to the log buffer until an explicit flush (e.g. via an assertion) occurs. This is fast and saves diskspace.

`stdout, nostdout`
Write the log content to standard output.

`stdout, nostdout`
Write the log content to standard error.

debugger, nodebugger
Write the log content to the debugger, if supported by the host OS.

com, nocom
Writes logging to the COM port. This is only applicable for raw-mode and ring-0 logging.

user, nouser
Custom destination which has no meaning to VM processes..

This corresponds to the `logdest` command in the debugger.

debugvm logflags

```
VBoxManage debugvm <uuid | vmname> logflags [--release | --debug]
[flags...]
```

Changes the flags on either debug (`--debug`) or release (`--release`) logger of the VM process. Please note that the modifications are applied onto the existing changes, they are not replacing them.

The *flags* are a list of flag mnemonics, optionally prefixed by a "no", "!", "~" or "-" to negate their meaning. The "+" prefix can be used to undo previous negation or use as a separator, though better use whitespace or separate arguments for that.

List of log flag mnemonics, with their counter form where applicable (asterisk indicates defaults):

enabled*, disabled
Enables or disables logging.

buffered, unbuffered*
Enabling buffering of log output before it hits the destinations.

writethrough(/writethru)
Whether to open the destination file with writethru buffering settings or not.

flush
Enables flushing of the output file (to disk) after each log statement.

lockcnts
Prefix each log line with lock counts for the current thread.

cpuid
Prefix each log line with the ID of the current CPU.

pid
Prefix each log line with the current process ID.

flagno
Prefix each log line with the numberic flags corresponding to the log statement.

flag
Prefix each log line with the flag mnemonics corresponding to the log statement.

groupno
Prefix each log line with the log group number for the log statement producing it.

group
Prefix each log line with the log group name for the log statement producing it.

tid
Prefix each log line with the current thread identifier.

thread
Prefix each log line with the current thread name.

time
Prefix each log line with the current UTC wall time.

timeprog
Prefix each log line with the current monotonic time since the start of the program.

msprog
Prefix each log line with the current monotonic timestamp value in milliseconds since the start of the program.

ts
Prefix each log line with the current monotonic timestamp value in nanoseconds.

tsc
Prefix each log line with the current CPU timestamp counter (TSC) value.

rel, abs*
Selects the whether `ts` and `tsc` prefixes should be displayed as relative to the previous log line or as absolute time.

hex*, dec
Selects the whether the `ts` and `tsc` prefixes should be formatted as hexadecimal or decimal.

custom
Custom log prefix, has by default no meaning for VM processes.

usecrlf, uself*
Output with DOS style (CRLF) or just UNIX style (LF) line endings.

overwrite*, append
Overwrite the destination file or append to it.

This corresponds to the `logflags` command in the debugger.

debugvm osdetect

```
VBoxManage debugvm <uuid | vmname> osdetect
```

Make the VMM's debugger facility (re)-detect the guest operating system (OS). This will first load all debugger plug-ins.

This corresponds to the `detect` command in the debugger.

debugvm osinfo

```
VBoxManage debugvm <uuid | vmname> osinfo
```

Displays information about the guest operating system (OS) previously detected by the VMM's debugger facility.

debugvm osdmesg

```
VBoxManage debugvm <uuid | vmname> osdmesg [--lines=lines]
```

Displays the guest OS kernel log, if detected and supported.

`--lines=` *lines*
Number of lines of the log to display, counting from the end. The default is infinite.

debugvm getregisters

```
VBoxManage debugvm <uuid | vmname> getregisters [--cpu=id]
[reg-set.reg-name...]
```

Retrieves register values for guest CPUs and emulated devices.

reg-set.reg-name
One of more registers, each having one of the following forms:

1. register-set.register-name.sub-field
2. register-set.register-name
3. cpu-register-name.sub-field
4. cpu-register-name
5. all

The *all* form will cause all registers to be shown (no sub-fields). The registers names are case-insensitive.

`--cpu=` *id*
Selects the CPU register set when specifying just a CPU register (3rd and 4th form). The default is 0.

debugvm setregisters

```
VBoxManage debugvm <uuid | vmname> setregisters [--cpu=id]
[reg-set.reg-name=value...]
```

Changes register values for guest CPUs and emulated devices.

reg-set.reg-name=value
One of more register assignment, each having one of the following forms:

1. register-set.register-name.sub-field=value
2. register-set.register-name=value
3. cpu-register-name.sub-field=value
4. cpu-register-name=value

The value format should be in the same style as what `getregisters` displays, with the exception that both octal and decimal can be used instead of hexadecimal.

`--cpu=` *id*
Selects the CPU register set when specifying just a CPU register (3rd and 4th form). The default is 0.

debugvm show

```
VBoxManage debugvm <uuid | vmname> show [--human-readable | --sh-export |
--sh-eval | --cmd-set] [settings-item...]
```

Shows logging settings for the VM.

`--human-readable`
Selects human readable output.

`--sh-export`
Selects output format as bourne shell style `export` commands.

`--sh-eval`
Selects output format as bourne shell style `eval` command input.

`--cmd-set`
Selects output format as DOS style `SET` commands.

settings-item
What to display. One or more of the following:

- logdbg-settings - debug log settings.
- logrel-settings - release log settings.
- log-settings - alias for both debug and release log settings.

debugvm stack

```
VBoxManage debugvm <uuid | vmname> stack [--cpu=id]
```

Unwinds the guest CPU stacks to the best of our ability. It is recommended to first run the `osdetect` command, as this gives both symbols and perhaps unwind information.

--cpu= ***id***
Selects a single guest CPU to display the stack for. The default is all CPUs.

debugvm statistics

```
VBoxManage debugvm <uuid | vmname> statistics [--reset] [--descriptions]
[--pattern=pattern]
```

Displays or resets VMM statistics.

Retrieves register values for guest CPUs and emulated devices.

--pattern= ***pattern***
DOS/NT-style wildcards patterns for selecting statistics. Multiple patterns can be specified by using the '|' (pipe) character as separator.

--reset
Select reset instead of display mode.

debugvm guestsample

```
VBoxManage debugvm <uuid | vmname> guestsample [--filename=filename]
[--sample-interval-us=interval] [--sample-time-us=time]
```

Creates a sample report of the guest activity.

Retrieves the filename to dump the report to.

--filename= ***filename***
The filename to dump the sample report to.

--sample-interval-us= ***interval***
The interval in microseconds between guest samples.

--sample-time-us= ***time***
The amount of microseconds to take guest samples.

VBoxManage dhcpserver

DHCP server management

Synopsis

```
VBoxManage dhcpserver add <--network=netname | --interface=ifname>
<--server-ip=address> <--netmask=mask> <--lower-ip=address>
<--upper-ip=address> <--enable | --disable>
[ [--global] [--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no
hexstring...] [--force-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
```

```
[--min-lease-time=seconds] [--default-lease-time=seconds]
[--max-lease-time=seconds]...]
[ <--group=name> [--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no
hexstring...] [--force-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--incl-mac=address...] [--excl-mac=address...] [--incl-mac-wild=pattern...]
[--excl-mac-wild=pattern...] [--incl-vendor=string...]
[--excl-vendor=string...] [--incl-vendor-wild=pattern...]
[--excl-vendor-wild=pattern...] [--incl-user=string...] [--excl-user=string...]
[--incl-user-wild=pattern...] [--excl-user-wild=pattern...]
[--min-lease-time=seconds] [--default-lease-time=seconds]
[--max-lease-time=seconds]...]
[ <--vm=name|uuid> [--nic=1-N] [--set-opt=dhcp-opt-no value...]
[--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--fixed-address=address]...]
[ <--mac-address=address> [--set-opt=dhcp-opt-no value...]
[--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--fixed-address=address]...]
```

```
VBoxManage dhcpserver modify <--network=netname | --interface=ifname>
[--server-ip=address] [--lower-ip=address] [--upper-ip=address]
[--netmask=mask] [--enable | --disable]
[ [--global] [--del-opt=dhcp-opt-no...] [--set-opt=dhcp-opt-no value...]
[--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--unforce-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--unsupress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--remove-config]...]
[ <--group=name> [--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no
hexstring...] [--force-opt=dhcp-opt-no...] [--unforce-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--unsupress-opt=dhcp-opt-no...]
[--del-mac=address...] [--incl-mac=address...] [--excl-mac=address...]
[--del-mac-wild=pattern...] [--incl-mac-wild=pattern...]
[--excl-mac-wild=pattern...] [--del-vendor=string...] [--incl-vendor=string...]
[--excl-vendor=string...] [--del-vendor-wild=pattern...]
[--incl-vendor-wild=pattern...] [--excl-vendor-wild=pattern...]
[--del-user=string...] [--incl-user=string...] [--excl-user=string...]
[--del-user-wild=pattern...] [--incl-user-wild=pattern...]
[--excl-user-wild=pattern...] [--zap-conditions] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--remove-config]...]
[ <--vm=name|uuid> [--nic=1-N] [--del-opt=dhcp-opt-no...]
[--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no hexstring...]
[--force-opt=dhcp-opt-no...] [--unforce-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--unsupress-opt=dhcp-opt-no...]
[--min-lease-time=seconds] [--default-lease-time=seconds]
[--max-lease-time=seconds] [--fixed-address=address] [--remove-config]...]
```

```
[ <--mac-address=address> [--del-opt=dhcp-opt-no...] [--set-opt=dhcp-opt-no
value...] [--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--unforce-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--unsupress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--fixed-address=address] [--remove-config]...]
```

```
VBoxManage dhcpserver remove <--network=netname | --interface=ifname>
```

```
VBoxManage dhcpserver start <--network=netname | --interface=ifname>
```

```
VBoxManage dhcpserver restart <--network=netname | --interface=ifname>
```

```
VBoxManage dhcpserver stop <--network=netname | --interface=ifname>
```

```
VBoxManage dhcpserver findlease <--network=netname | --interface=ifname>
<--mac-address=mac>
```

Description

The `dhcpserver` commands enable you to control the DHCP server that is built into VirtualBox. You may find this useful when using internal or host-only networking. Theoretically, you can also enable it for a bridged network, but that may cause conflicts with other DHCP servers in your physical network.

Common options

The subcommands of `dhcpserver` all operate on an internal network that can be identified via its name or in the host-only case via the host-only interface name:

--network=*netname*
The internal network name. This is the same as you would use as value to the `VBoxManage modifyvm --intnet` option when configuring a VM for internal networking. Or you see as VBoxNetworkName in the output from `VBoxManage list intnets`, `VBoxManage list natnets`, or `VBoxManage list hostonlyifs`.

--interface=*ifname*
The host only interface name. This would be same value as you would use for the `VBoxManage modifyvm --host-only-adapter` option when configuring a VM to use a host-only network. The value can also be found in the Name row in `VBoxManage list hostonlyifs`.

dhcpserver add

```
VBoxManage dhcpserver add <--network=netname | --interface=ifname>
<--server-ip=address> <--netmask=mask> <--lower-ip=address>
<--upper-ip=address> <--enable | --disable>
[ [--global] [--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no
hexstring...] [--force-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--min-lease-time=seconds] [--default-lease-time=seconds]
[--max-lease-time=seconds]...]
[ <--group=name> [--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no
hexstring...] [--force-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--incl-mac=address...] [--excl-mac=address...] [--incl-mac-wild=pattern...]
[--excl-mac-wild=pattern...] [--incl-vendor=string...]
[--excl-vendor=string...] [--incl-vendor-wild=pattern...]
[--excl-vendor-wild=pattern...] [--incl-user=string...] [--excl-user=string...]
[--incl-user-wild=pattern...] [--excl-user-wild=pattern...]
[--min-lease-time=seconds] [--default-lease-time=seconds]
[--max-lease-time=seconds]...]
[ <--vm=name|uuid> [--nic=1-N] [--set-opt=dhcp-opt-no value...]
[--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--fixed-address=address]...]
[ <--mac-address=address> [--set-opt=dhcp-opt-no value...]
[--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--fixed-address=address]...]
```

Adds a new DHCP server to a network or host-only interface.

Options configuring the DHCP server core:

`--server-ip=` *address*
The IP address the DHCP server should use.

`--lower-ip=`*address*, `--upper-ip=`*address*
The IP address range for the DHCP server to manage. This should not include the address of the DHCP server itself, but it must be in the same network as it. The boundraries are inclusive, so both the lower and upper addresses will be handed out to clients.

`--netmask=` *mask*
The network mask. Typically 255.255.255.0.

`--enable`, `--disable`
Whether to enable the DHCP server or disable it. If not specified, the server will be created in disabled state and no IP addresses handed out.

Options selecting the scope:

`--global`
Set the configuration scope to global. Any subsequent `--set-opt` options will be apply to all the DHCP clients.

`--vm=` *vmname|uuid*
Set the configuration scope to the first NIC of the specified VM. Any subsequent `--set-opt` options will apply just to that interface, nothing else.

`--nic=` *1-N*
Set the configuration scope to a NIC other than first of the VM specified the in `--vm`.

`--mac-address=` *address*
Set the configuration scope to the specified MAC address.

`--group=` *name*
Set the configuration scope to the specified group.

Options configuring the currently selected scope:

`--set-opt=` *dhcp-opt-no value*
Adds the specified DHCP option number (0-255) and value. The value format is option specific (typically human readable) and will be validated by the API and the DHCP server.

`--set-opt-hex=` *dhcp-opt-no hexstring*
Adds the specified DHCP option number (0-255) and value. The option value is specified as a raw series of hex bytes, optionally separated by colons. No validation is performed on these by the API or the DHCP server, they will be pass as specified to the client.

`--force-opt=` *dhcp-opt-no*
Forces the specified DHCP option number (0-255) onto to be sent to the client whether it requested it or not (provided the option is configured with a value at some level).

`--suppress-opt=` *dhcp-opt-no*
Prevents the specified DHCP option number (0-255) from being sent to the client when present in this or a high configuration scope.

`--min-lease-time=` *seconds*
Sets the minimum lease time for the current scope in seconds. Zero means taking the value from a higher option level or use default.

`--default-lease-time=` *seconds*
Sets the default lease time for the current scope in seconds. Zero means taking the value from a higher option level or use default.

`--max-lease-time=` *seconds*
Sets the maximum lease time for the current scope in seconds. Zero means taking the value from a higher option level or use default.

`--fixed-address=` *address*
Fixed address assignment for a `--vm` or `--mac-address` configuration scope. Any empty *address* turns it back to dynamic address assignment.

Options configuring group membership conditions (excludes overrides includes):

`--incl-mac=` *address*
Include the specific MAC address in the group.

`--excl-mac=` *address*
Exclude the specific MAC address from the group.

`--incl-mac-wild=` *pattern*
Include the specific MAC address pattern in the group.

`--excl-mac-wild=` *pattern*
Exclude the specific MAC address pattern from the group.

`--incl-vendor=` *string*
Include the specific vendor class ID in the group.

`--excl-vendor=` *string*
Exclude the specific vendor class ID from the group.

`--incl-vendor-wild=` *pattern*
Include the specific vendor class ID pattern in the group.

`--excl-vendor-wild=` *pattern*
Exclude the specific vendor class ID pattern from the group.

`--incl-user=` *string*
Include the specific user class ID in the group.

`--excl-user=` *string*
Exclude the specific user class ID from the group.

`--incl-user-wild=` *pattern*
Include the specific user class ID pattern in the group.

`--excl-user-wild=` *pattern*
Exclude the specific user class ID pattern from the group.

dhcpserver modify

```
VBoxManage dhcpserver modify <--network=netname | --interface=ifname>
[--server-ip=address] [--lower-ip=address] [--upper-ip=address]
[--netmask=mask] [--enable | --disable]
[ [--global] [--del-opt=dhcp-opt-no...] [--set-opt=dhcp-opt-no value...]
[--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--unforce-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--unsupress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--remove-config]...]
[ <--group=name> [--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no
hexstring...] [--force-opt=dhcp-opt-no...] [--unforce-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--unsupress-opt=dhcp-opt-no...]
```

```
[--del-mac=address...] [--incl-mac=address...] [--excl-mac=address...]
[--del-mac-wild=pattern...] [--incl-mac-wild=pattern...]
[--excl-mac-wild=pattern...] [--del-vendor=string...] [--incl-vendor=string...]
[--excl-vendor=string...] [--del-vendor-wild=pattern...]
[--incl-vendor-wild=pattern...] [--excl-vendor-wild=pattern...]
[--del-user=string...] [--incl-user=string...] [--excl-user=string...]
[--del-user-wild=pattern...] [--incl-user-wild=pattern...]
[--excl-user-wild=pattern...] [--zap-conditions] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--remove-config]...]
[ <--vm=name|uuid> [--nic=1-N] [--del-opt=dhcp-opt-no...]
[--set-opt=dhcp-opt-no value...] [--set-opt-hex=dhcp-opt-no hexstring...]
[--force-opt=dhcp-opt-no...] [--unforce-opt=dhcp-opt-no...]
[--supress-opt=dhcp-opt-no...] [--unsupress-opt=dhcp-opt-no...]
[--min-lease-time=seconds] [--default-lease-time=seconds]
[--max-lease-time=seconds] [--fixed-address=address] [--remove-config]...]
[ <--mac-address=address> [--del-opt=dhcp-opt-no...] [--set-opt=dhcp-opt-no
value...] [--set-opt-hex=dhcp-opt-no hexstring...] [--force-opt=dhcp-opt-no...]
[--unforce-opt=dhcp-opt-no...] [--supress-opt=dhcp-opt-no...]
[--unsupress-opt=dhcp-opt-no...] [--min-lease-time=seconds]
[--default-lease-time=seconds] [--max-lease-time=seconds]
[--fixed-address=address] [--remove-config]...]
```

This modifies an existing DHCP server configuration. It takes the same options as the `add` command with the addition of the following on scope configuration:

`--del-opt=` *dhcp-opt-no*
Counterpart to `--set-opt` that will cause the specified DHCP option number (0-255) to be deleted from the server settings. Like with `--set-opt` the scope of the deletion is governed by the `--global`, `--vm`, `--mac-address` and `--group` options.

`--unforce-opt=` *dhcp-opt-no*
Removes the specified DHCP option number (0-255) from the forced option list (i.e. the reverse of `--force-opt`). Like with `--set-opt` the scope of the deletion is governed by the `--global`, `--vm`, `--mac-address` and `--group` options.

`--unsuppress-opt=` *dhcp-opt-no*
Removes the specified DHCP option number (0-255) from the supressed option list (i.e. the reverse of `--suppress-opt`). Like with `--set-opt` the scope of the deletion is governed by the `--global`, `--vm`, `--mac-address` and `--group` options.

`--remove-config`
Removes the configuration currently being scoped. The `--global` scope is not removable. The configuration scope will change to `--global` after this option.

And the addition of these group membership condition options:

`--del-mac=` *address*
Delete the specific MAC address from the group conditions.

`--del-mac-wild=` *pattern*
Delete the specific MAC address pattern from the group conditions.

--del-vendor= ***string***
Delete the specific vendor class ID from the group conditions.

--del-vendor-wild= ***pattern***
Delete the specific vendor class ID pattern from the group conditions.

--del-user= ***string***
Delete the specific user class ID from the group conditions.

--del-user-wild= ***pattern***
Delete the specific user class ID pattern from the group conditions.

--zap-conditions
Deletes all the group conditions.

dhcpserver remove

```
VBoxManage dhcpserver remove <--network=netname | --interface=ifname>
```

Removes the specified DHCP server.

dhcpserver start

```
VBoxManage dhcpserver start <--network=netname | --interface=ifname>
```

Start the specified DHCP server.

dhcpserver restart

```
VBoxManage dhcpserver restart <--network=netname | --interface=ifname>
```

Restarts the specified DHCP server. The DHCP server must be running.

dhcpserver stop

```
VBoxManage dhcpserver stop <--network=netname | --interface=ifname>
```

Stops the specified DHCP server.

dhcpserver findlease

```
VBoxManage dhcpserver findlease <--network=netname | --interface=ifname>
<--mac-address=mac>
```

Performs a lease database lookup. This is mainly for getting the IP address of a running VM.

`--mac-address=` *mac*
The MAC address to lookup in the lease database.

Common DHCP Options:

1 - SubnetMask
IPv4 netmask. Set to the value of the --netmask option by default.

2 - TimeOffset
UTC offset in seconds (32-bit decimal value).

3 - Routers
Space separated list of IPv4 router addresses.

4 - TimeServers
Space separated list of IPv4 time server (RFC 868) addresses.

5 - NameServers
Space separated list of IPv4 name server (IEN 116) addresses.

6 - DomainNameServers
Space separated list of IPv4 DNS addresses.

7 - LogServers
Space separated list of IPv4 log server addresses.

8 - CookieServers
Space separated list of IPv4 cookie server (RFC 865) addresses.

9 - LPRServers
Space separated list of IPv4 line printer server (RFC 1179) addresses.

10 - ImpressServers
Space separated list of IPv4 imagen impress server addresses.

11 - ResourseLocationServers
Space separated list of IPv4 resource location (RFC 887) addresses.

12 - HostName
The client name. See RFC 1035 for character limits.

13 - BootFileSize
Number of 512 byte blocks making up the boot file (16-bit decimal value).

14 - MeritDumpFile
Client core file.

15 - DomainName
Domain name for the client.

16 - SwapServer
IPv4 address of the swap server that the client should use.

17 - RootPath
The path to the root disk the client should use.

18 - ExtensionPath
Path to a file containing additional DHCP options (RFC2123).

19 - IPForwarding
Whether IP forwarding should be enabled by the client (boolean).

20 - OptNonLocalSourceRouting
Whether non-local datagrams should be forwarded by the client (boolean)

21 - PolicyFilter
List of IPv4 addresses and masks paris controlling non-local source routing.

22 - MaxDgramReassemblySize
The maximum datagram size the client should reassemble (16-bit decimal value).

23 - DefaultIPTTL
The default time-to-leave on outgoing (IP) datagrams (8-bit decimal value).

24 - PathMTUAgingTimeout
RFC1191 path MTU discovery timeout value in seconds (32-bit decimal value).

25 - PathMTUPlateauTable
RFC1191 path MTU discovery size table, sorted in ascending order (list of 16-bit decimal values).

26 - InterfaceMTU
The MTU size for the interface (16-bit decimal value).

27 - AllSubnetsAreLocal
Indicates whether the MTU size is the same for all subnets (boolean).

28 - BroadcastAddress
Broadcast address (RFC1122) for the client to use (IPv4 address).

29 - PerformMaskDiscovery
Whether to perform subnet mask discovery via ICMP (boolean).

30 - MaskSupplier
Whether to respond to subnet mask requests via ICMP (boolean).

31 - PerformRouterDiscovery
Whether to perform router discovery (RFC1256) (boolean).

32 - RouterSolicitationAddress
Where to send router solicitation requests (RFC1256) (IPv4 address).

33 - StaticRoute
List of network and router address pairs addresses.

34 - TrailerEncapsulation
Whether to negotiate the use of trailers for ARP (RTF893) (boolean).

35 - ARPCacheTimeout
The timeout in seconds for ARP cache entries (32-bit decimal value).

36 - EthernetEncapsulation
Whether to use IEEE 802.3 (RTF1042) rather than of v2 (RFC894) ethernet encapsulation (boolean).

37 - TCPDefaultTTL
Default time-to-live for TCP sends (non-zero 8-bit decimal value).

38 - TCPKeepaliveInterval
The interface in seconds between TCP keepalive messages (32-bit decimal value).

39 - TCPKeepaliveGarbage
Whether to include a byte of garbage in TCP keepalive messages for backward compatibility (boolean).

40 - NISDomain
The NIS (Sun Network Information Services) domain name (string).

41 - NISServers
Space separated list of IPv4 NIS server addresses.

42 - NTPServers
Space separated list of IPv4 NTP (RFC1035) server addresses.

43 - VendorSpecificInfo
Vendor specific information. Only accessible using --set-opt-hex.

44 - NetBIOSNameServers
Space separated list of IPv4 NetBIOS name server (NBNS) addresses (RFC1001,RFC1002).

45 - NetBIOSDatagramServers
Space separated list of IPv4 NetBIOS datagram distribution server (NBDD) addresses (RFC1001,RFC1002).

46 - NetBIOSNodeType
NetBIOS node type (RFC1001,RFC1002): 1=B-node, 2=P-node, 4=M-node, and 8=H-node (8-bit decimal value).

47 - NetBIOSScope
NetBIOS scope (RFC1001,RFC1002). Only accessible using --set-opt-hex.

48 - XWindowsFontServers
Space separated list of IPv4 X windows font server addresses.

49 - XWindowsDisplayManager
Space separated list of IPv4 X windows display manager addresses.

62 - NetWareIPDomainName
Netware IP domain name (RFC2242) (string).

63 - NetWareIPInformation
Netware IP information (RFC2242). Only accessible using --set-opt-hex.

64 - NISPlusDomain
The NIS+ domain name (string).

65 - NISPlusServers
Space separated list of IPv4 NIS+ server addresses.

66 - TFTPServerName
TFTP server name (string).

67 - BootfileName
Bootfile name (string).

68 - MobileIPHomeAgents
Space separated list of IPv4 mobile IP agent addresses.

69 - SMTPServers
Space separated list of IPv4 simple mail transport protocol (SMPT) server addresses.

70 - POP3Servers
Space separated list of IPv4 post office protocol 3 (POP3) server addresses.

71 - NNTPServers
Space separated list of IPv4 network news transport protocol (NTTP) server addresses.

72 - WWWServers
Space separated list of default IPv4 world wide web (WWW) server addresses.

73 - FingerServers
Space separated list of default IPv4 finger server addresses.

74 - IRCServers
Space separated list of default IPv4 internet relay chat (IRC) server addresses.

75 - StreetTalkServers
Space separated list of IPv4 StreetTalk server addresses.

76 - STDAServers
Space separated list of IPv4 StreetTalk directory assistance (STDA) server addresses.

78 - SLPDirectoryAgent
Addresses of one or more service location protocol (SLP) directory agent, and an indicator of whether their use is mandatory. Only accessible using --set-opt-hex.

79 - SLPServiceScope
List of service scopes for the service location protocol (SLP) and whether using the list is mandator. Only accessible using --set-opt-hex.

119 - DomainSearch
Domain search list, see RFC3397 and section 4.1.4 in RFC1035 for encoding. Only accessible using --set-opt-hex.

VBoxManage discardstate

Discard the saved state of a virtual machine

Synopsis

```
VBoxManage discardstate <uuid | vmname>
```

Description

The `VBoxManage discardstate` command discards the saved state of a virtual machine (VM) that is not currently running. This command causes the VM's operating system to restart the next time you start the VM.

> **Note:**
>
> Where possible, avoid performing this action. The effects of this command are equivalent to unplugging the power cable on a physical machine.

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or name of the VM.

Examples

The following command discards the saved state file for the VM called `vm2`. When you next start the VM, the VM's operating system is restarted.

```
$ VBoxManage discardstate vm2
```

See Also

VBoxManage adoptstate

VBoxManage encryptmedium

Manage a DEK-encrypted medium or image

Synopsis

```
VBoxManage encryptmedium <uuid | filename> [--cipher=cipher-ID]
[--newpassword=password] [--newpasswordid=password-ID]
[--oldpassword=password]
```

Description

The `VBoxManage encryptmedium` command enables you to create and manage a DEK-encrypted medium or image. You can encrypt an image, decrypt an image, and change the encryption password of an image. See Encrypting Disk Images.

uuid | filename
Specifies the Universally Unique Identifier (UUID) or the absolute path name of the medium or image to encrypt.

`--newpassword=` *password*
Specifies the new encryption password. *password* is either the absolute path name of a password file on the host operating system or `-`, which prompts you for the password.
You must use the `--newpasswordid` option with this `--newpassword` option.

`--oldpassword=` *password*
Specifies the original encryption password. *password* is either the absolute path name of a password file on the host operating system or `-`, which prompts you for the original password.
This option enables you to gain access to an encrypted medium or image to do the following:

- Decrypt an encrypted image by using this option by itself.
- Change the password of the encrypted image by using the `--newpassword` option.
- Change the encryption cipher of the image by using the `--cipher` option.

`--cipher=` *cipher-ID*
Specifies the cipher to use for encryption. Valid values are `AES-XTS128-PLAIN64` or `AES-XTS256-PLAIN64`.
This option enables you to set up or change encryption on the medium or image.

`--newpasswordid=` *password-ID*
Specifies a new password identifier that is used for correct identification when supplying multiple passwords during VM startup.
If you use the same password and password identifier when encrypting multiple images, you need to supply the password only one time during VM startup.

Examples

The following example shows how to encrypt the `ol7u4-1.vdi` image by using the `AES-XTS128-PLAIN64` cipher, specifying a password identifier of `1001`, and using the `$HOME/pwfile` password file:

```
$ VBoxManage encryptmedium "$HOME/VirtualBox VMs/ol7u4/ol7u4-1.vdi" \
  --cipher="AES-XTS128-PLAIN64" --newpasswordid="1001" --newpassword=$HOME/pwfile
```

The following example shows how to decrypt an encrypted image called `ol7u4-2.vdi`:

```
$ VBoxManage encryptmedium "$HOME/VirtualBox VMs/ol7u4/ol7u4-2.vdi" \
  --oldpassword=-
  Password: original-password
```

The following example shows how to change the password for an encrypted image called `ol7u4-3.vdi`. The command reads the original password from the `$HOME/pwfile.orig` file, reads the new password from the `$HOME/pwfile` file, and assigns a password identifier of `1001`.

```
$ VBoxManage encryptmedium "$HOME/VirtualBox VMs/ol7u4/ol7u4-3.vdi" \
  --oldpassword=$HOME/pwfile.orig --newpassword=$HOME/pwfile --newpasswordid="1001"
```

VBoxManage encryptvm

Change encryption and passwords of the VM

Synopsis

```
VBoxManage encryptvm <uuid | vmname> setencryption --old-password file
--cipher cipher-identifier --new-password file --new-password-id password-identifier
--force
```

```
VBoxManage encryptvm <uuid | vmname> checkpassword <file>
```

```
VBoxManage encryptvm <uuid | vmname> addpassword --password file
--password-id password-identifier
```

```
VBoxManage encryptvm <uuid | vmname> removepassword <password-identifier>
```

Description

The `VBoxManage encryptvm` command enables you to change the encryption or add and remove user passwords for the virtual machine (VM). The following sections describe the subcommands that you can use:

Set encryption of the Virtual Machine

```
VBoxManage encryptvm <uuid | vmname> setencryption --old-password file
--cipher cipher-identifier --new-password file --new-password-id password-identifier
--force
```

The `VBoxManage encryptvm vmname setencryption` command changes encryption of a VM.

Use the `--old-password` to supply old encryption password. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the old password.

Use the `--cipher` option to specify the new cipher for encryption of the VM. Only `AES-128` and `AES-256` are supported. Appropriate mode GCM, CTR or XTS will be selected by VM depending on encrypting component.

Use the `--new-password` option to specify the new password for encryption of the VM. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the new password.

Use the `--new-password-id` option to specify the new id for the password for encryption of the VM.

Use the `--force` option to make the system to reencrypt the VM instead of simple changing the password.

Check the supplied password is correct

`VBoxManage encryptvm` <*uuid* | *vmname*> `checkpassword` <*file*>

The `VBoxManage encryptvm` *vmname* `checkpassword` command checks the correctness of the supplied password.

The password can be supplied from file. Specify the absolute pathname of a password file on the host operating system. Also, you can specify - to prompt you for the password.

Add password for decrypting the Virtual Machine

`VBoxManage encryptvm` <*uuid* | *vmname*> `addpassword` `--password`*file* `--password-id`*password-identifier*

The `VBoxManage encryptvm` *vmname* `addpassword` command adds a password for decrypting the VM.

Use the `--password` to supply the encryption password. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the password.

Use the `--password-id` option to specify the id the password is supplied for.

Remove password used for decrypting the Virtual Machine

`VBoxManage encryptvm` <*uuid* | *vmname*> `removepassword` <*password-identifier*>

The `VBoxManage encryptvm` *vmname* `removepassword` command removes a password used for decrypting the VM.

Specify the password identifier for removing. The password becomes unknown and the VM can not be decrypted.

Examples

The following command encrypts the `ol7` VM using AES-256 giving password via command prompt:

```
$ VBoxManage encryptvm ol7 setencryption --cipher=AES-256 --new-password - --new-password-id vmid
```

See Also

VBoxManage createvm,

VBoxManage export

Export one or more virtual machines to a virtual appliance or to a cloud service

Synopsis

```
VBoxManage export <machines> <--output=name> [--legacy09 | --ovf09 |
--ovf10 | --ovf20] [--manifest] [--options=manifest | iso | nomacs |
nomacsbutnat...] [--vsys=virtual-system-number] [--description=description-info]
[--eula=license-text] [--eulafile=filename] [--product=product-name]
[--producturl=product-URL] [--vendor=vendor-name] [--vendorurl=vendor-URL]
[--version=version-info] [--vmname=vmname]
```

```
VBoxManage export <machine> <--output=cloud-service-provider> [--opc10]
[--vmname=vmname] [--cloud=virtual-system-number]
[--cloudprofile=cloud-profile-name] [--cloudshape=cloud-shape-name]
[--clouddomain=cloud-domain] [--clouddisksize=disk-size-in-GB]
[--cloudbucket=bucket-name] [--cloudocivcn=OCI-VCN-ID]
[--cloudocisubnet=OCI-subnet-ID] [--cloudkeepobject=true | false]
[--cloudlaunchinstance=true | false] [--cloudlaunchmode=EMULATED |
PARAVIRTUALIZED] [--cloudpublicip=true | false]
```

Description

The `VBoxManage export` command enables you to export one or more virtual machines (VMs) from Oracle VM VirtualBox. You can export the VM to one of the following:

- *Virtual appliance in OVF format.* Includes the copying of its virtual disk images to compressed VMDK.
- *Cloud service such as Oracle Cloud Infrastructure.* Exports a single VM.

For more information about exporting VMs from Oracle VM VirtualBox, see Importing and Exporting Virtual Machines

Export a Virtual Machine to an OVF Virtual Appliance

```
VBoxManage export <machines> <--output=name> [--legacy09 | --ovf09 |
--ovf10 | --ovf20] [--manifest] [--options=manifest | iso | nomacs |
nomacsbutnat...] [--vsys=virtual-system-number] [--description=description-info]
[--eula=license-text] [--eulafile=filename] [--product=product-name]
[--producturl=product-URL] [--vendor=vendor-name] [--vendorurl=vendor-URL]
[--version=version-info] [--vmname=vmname]
```

The `VBoxManage export` command enables you to export a VM as a virtual appliance in OVF format.

machines
Specifies a comma-separated list of one or more machines to export to the same OVF file.

`--output=` ***filename***
Specifies the target OVF file. The file can be OVF, OVA, or a ZIP file compressed with the `gzip` command. Because the directory that contains the target OVF file will also store the exported disk images in the compressed VMDK format, ensure that this directory has sufficient disk space in which to store the images.
The short form of this option is `-o`.

`--legacy09`
Exports in OVF 0.9 legacy mode if the virtualization product is not fully compatible with the OVF 1.0 standard.

`--ovf09`
Exports in OVF 0.9 format.

`--ovf10`
Exports in OVF 1.0 format.

`--ovf20`
Exports in OVF 2.0 format.

`--manifest`
Creates a manifest of the exported files.

`--options=` ***argument*** **`,...`**
Specifies information to control the exact content of the appliance file. Specify one or more comma-separated arguments:

`manifest`
Produces a manifest file that detects corrupted appliances on import.

`iso`
Exports DVD images in an ISO file.

`nomacs`
Excludes all MAC addresses.

nomacsbutnat
Excludes all MAC addresses except for those in a NAT network.

--description= ***description-info***
Specifies a description of the VM.

--eula= ***license-text***
Specifies end-user license text.

--eulafile= ***filename***
Specifies an end-user license file.

--product= ***product-name***
Specifies a product name.

--producturl= ***product-URL***
Specifies a product URL.

--vendor= ***vendor-name***
Specifies a vendor name.

--vendorurl= ***vendor-URL***
Specifies a vendor URL.

--version= ***version-info***
Specifies version information.

--vmname= ***vmname***
Specifies the name of the exported VM.

--vsys= ***virtual-system-number***
Specifies the number of the virtual system.

Export a Virtual Machine to Oracle Cloud Infrastructure

```
VBoxManage export <machine> <--output=cloud-service-provider> [--opc10]
[--vmname=vmname] [--cloud=virtual-system-number]
[--cloudprofile=cloud-profile-name] [--cloudshape=cloud-shape-name]
[--clouddomain=cloud-domain] [--clouddisksize=disk-size-in-GB]
[--cloudbucket=bucket-name] [--cloudocivcn=OCI-VCN-ID]
[--cloudocisubnet=OCI-subnet-ID] [--cloudkeepobject=true | false]
[--cloudlaunchinstance=true | false] [--cloudlaunchmode=EMULATED |
PARAVIRTUALIZED] [--cloudpublicip=true | false]
```

The `VBoxManage export` command enables you to export a VM to a cloud service provider such as Oracle Cloud Infrastructure. By default, the exported disk image is converted into compressed VMDK format. This minimizes the amount of data to transfer to the cloud service.

Some of the following options are configuration settings for the VM instance. As a result, specify an Oracle Cloud Identifier (OCID) for a resource. Use the Oracle Cloud Infrastructure Console to view OCIDs.

`--output=` *cloud-service-provider*
Specifies the short name of the cloud service provider to which you export the VM. For Oracle Cloud Infrastructure, specify `OCI://`.
The short form of this option is `-o`.

`--opc10`
Exports in Oracle Cloud Infrastructure format.

`--cloud=` *number-of-virtual-system*
Specifies a number that identifies the VM to export. Numbering starts at `0` for the first VM.

`--vmname=` *vmname*
Specifies the name of the exported VM, which is used as the VM instance name in Oracle Cloud Infrastructure.

`--cloudprofile=` *cloud-profile-name*
Specifies the cloud profile to use to connect to the cloud service provider. The cloud profile contains your Oracle Cloud Infrastructure account details, such as your user OCID and the fingerprint for your public key.
To use a cloud profile, you must have the required permissions on Oracle Cloud Infrastructure.

`--cloudshape=` *cloud-shape-name*
Specifies the shape used by the VM instance. The shape defines the number of CPUs and the amount of memory that is allocated to the VM instance. Ensure that the shape is compatible with the exported image.

`--clouddomain=` *cloud-domain*
Specifies the availability domain to use for the VM instance. Enter the full name of the availability domain.

`--clouddisksize=` *disk-size-in-GB*
Specifies the amount of disk space, in gigabytes, to use for the exported disk image. Valid values are from 50 GB to 300 GB.

`--cloudbucket=` *bucket-name*
Specifies the bucket in which to store uploaded files. In Oracle Cloud Infrastructure, a bucket is a logical container for storing objects.

`--cloudocivcn=` *OCI-VCN-ID*
Specifies the OCID of the virtual cloud network (VCN) to use for the VM instance.

`--cloudocisubnet=` *OCI-subnet-ID*
Specifies the OCID of the VCN subnet to use for the VM instance.

`--cloudkeepobject=true | false`
Specifies whether to store the exported disk image in Oracle Object Storage.

`--cloudlaunchinstance=true | false`
Specifies whether to start the VM instance after the export to Oracle Cloud Infrastructure completes.

`--cloudlaunchinstance=EMULATED | PARAVIRTUALIZED`
Specifies the launch mode used for the instance. Paravirtualized mode gives improved performance.

`--cloudpublicip=true | false`
Specifies whether to enable a public IP address for the VM instance.

Example

The following example shows how to export the `myVM` VM to Oracle Cloud Infrastructure. The command's option arguments describe the configuration of the `myVM_Cloud` VM in Oracle Cloud Infrastructure.

```
# VBoxManage export myVM --output=OCI:// --cloud=0 --vmname=myVM_Cloud \
--cloudprofile="standard user" --cloudbucket=myBucket \
--cloudshape=VM.Standard2.1 --clouddomain=US-ASHBURN-AD-1 --clouddisksize=50  \
--cloudocivcn=ocid1.vcn.oc1.iad.aaaa... --cloudocisubnet=ocid1.subnet.oc1.iad.aaaa... \
--cloudkeepobject=true --cloudlaunchinstance=true --cloudpublicip=true
```

VBoxManage extpack

Extension package management

Synopsis

```
VBoxManage extpack install [--replace] [--accept-license=sha256] <tarball>
```

```
VBoxManage extpack uninstall [--force] <name>
```

```
VBoxManage extpack cleanup
```

Description

extpack install

```
VBoxManage extpack install [--replace] [--accept-license=sha256] <tarball>
```

Installs a new extension pack on the system. This command will fail if an older version of the same extension pack is already installed. The `--replace` option can be used to uninstall any old package before the new one is installed.

`--replace`
Uninstall existing extension pack version.

`--accept-license=` *`sha256`*
Accept the license text with the given SHA-256 hash value.

VBoxManage will display the SHA-256 value when performing a manual installation. The hash can of course be calculated by looking inside the extension pack and using sha256sum or similar on the license file.

tarball
The file containing the extension pack to be installed.

extpack uninstall

```
VBoxManage extpack uninstall [--force] <name>
```

Uninstalls an extension pack from the system. The subcommand will also succeed in the case where the specified extension pack is not present on the system. You can use `VBoxManage list extpacks` to show the names of the extension packs which are currently installed.

`--force`
Overrides most refusals to uninstall an extension pack

name
The name of the extension pack to be uninstalled.

extpack cleanup

```
VBoxManage extpack cleanup
```

Used to remove temporary files and directories that may have been left behind if a previous install or uninstall command failed.

Examples

How to list extension packs:

```
$ VBoxManage list extpacks
Extension Packs: 1
Pack no. 0:   Oracle VM VirtualBox Extension Pack
Version:      4.1.12
Revision:     77218
Edition:
Description:  USB 2.0 Host Controller, VirtualBox RDP, PXE ROM with E1000 support.
VRDE Module:  VBoxVRDP
Usable:       true
Why unusable:
```

How to remove an extension pack:

```
$ VBoxManage extpack uninstall "Oracle VM VirtualBox Extension Pack"
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
Successfully uninstalled "Oracle VM VirtualBox Extension Pack".
```

VBoxManage getextradata

View keyword values that are associated with a virtual machine or configuration

Synopsis

```
VBoxManage getextradata <global | uuid | vmname> <keyword | enumerate>
```

Description

The `VBoxManage getextradata` command enables you to retrieve keyword data that is associated with a virtual machine (VM) or with an Oracle VM VirtualBox configuration.

`global`
Specifies to retrieve information about the configuration rather than a VM.

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or name of the VM.

`enumerate`
Shows all keyword values for the specified VM or configuration.

keyword
Specifies the keyword for which to retrieve its value.

Examples

The following command retrieves the `installdate` keyword value for the `Fedora5` VM:

```
$ VBoxManage getextradata Fedora5 installdate
VirtualBox Command Line Management Interface Version version-number
Copyright (C) 2005-2023 Oracle and/or its affiliates

Value: 2006.01.01
```

The following command retrieves the information for all keywords of the `OracleLinux7u4` VM:

```
$ VBoxManage getextradata OracleLinux7u4 enumerate
Key: GUI/LastCloseAction, Value: PowerOff
Key: GUI/LastGuestSizeHint, Value: 1048,696
Key: GUI/LastNormalWindowPosition, Value: 851,286,1048,738
```

The following command retrieves the information for all keywords in the configuration:

```
$ VBoxManage getextradata global enumerate
Key: GUI/Details/Elements, Value:
general,system,preview,display,storage,audio,network,usb,sharedFolders,description
Key: GUI/DetailsPageBoxes, Value:
general,system,preview,display,storage,audio,network,usb,sharedFolders,description
Key: GUI/GroupDefinitions/, Value:
m=43349dd8-2aa3-41b8-988f-0e255ce68090,m=9ebcd81e-5231-48ce-
a27d-28218757f3fe,m=c690e8b1-93a0-4c95-9cd7-6437fff93251,m=f7c1e10d-3722-4891-887e-07b3c4
104946
Key: GUI/HideDescriptionForWizards, Value: NewVM
```

```
Key: GUI/LastItemSelected, Value: m=ol7u4
Key: GUI/LastWindowPosition, Value: 951,510,960,520
Key: GUI/RecentFolderCD, Value: C:/Users/user1
Key: GUI/RecentListCD, Value:
C:\Users\user1\V1.iso,C:\Users\user1\V2.iso,C:\Users\user1\V3.iso
Key: GUI/SplitterSizes, Value: 318,637
Key: GUI/SuppressMessages, Value: remindAboutMouseIntegration,remindAboutAutoCapture
Key: GUI/Toolbar/MachineTools/Order, Value: Details
Key: GUI/Tools/LastItemsSelected, Value: Welcome,Details
Key: GUI/UpdateCheckCount, Value: 71
Key: GUI/UpdateDate, Value: 1 d, 2019-04-10, stable, 5.2.22
Key: GUI/VirtualMediaManager/Details/Expanded, Value: true
```

See Also

VBoxManage setextradata

VBoxManage guestcontrol

Control a virtual machine from the host system

Synopsis

```
VBoxManage guestcontrol <uuid | vmname> run [--arg0=argument 0]
[--domain=domainname] [--dos2unix] [--exe=filename]
[--ignore-orphaned-processes] [--no-wait-stderr | --wait-stderr]
[--no-wait-stdout | --wait-stdout] [--passwordfile=password-file |
--password=password] [--profile] [--putenv=var-name=[value]] [--quiet]
[--timeout=msec] [--unix2dos] [--unquoted-args] [--username=username]
[--cwd=directory] [--verbose] <--[argument...]>
```

```
VBoxManage guestcontrol <uuid | vmname> start [--arg0=argument 0]
[--domain=domainname] [--exe=filename] [--ignore-orphaned-processes]
[--passwordfile=password-file | --password=password] [--profile]
[--putenv=var-name=[value]] [--quiet] [--timeout=msec] [--unquoted-args]
[--username=username] [--cwd=directory] [--verbose] <--[argument...]>
```

```
VBoxManage guestcontrol <uuid | vmname> copyfrom [--dereference]
[--domain=domainname] [--passwordfile=password-file | --password=password]
[--quiet] [--no-replace] [--recursive]
[--target-directory=host-destination-dir] [--update] [--username=username]
[--verbose] <guest-source0> guest-source1[...] <host-destination>
```

```
VBoxManage guestcontrol <uuid | vmname> copyto [--dereference]
[--domain=domainname] [--passwordfile=password-file | --password=password]
```

```
[--quiet] [--no-replace] [--recursive]
[--target-directory=guest-destination-dir] [--update] [--username=username]
[--verbose] <host-source0> host-source1[...]
```

```
VBoxManage guestcontrol <uuid | vmname> mkdir [--domain=domainname]
[--mode=mode] [--parents] [--passwordfile=password-file |
--password=password] [--quiet] [--username=username] [--verbose]
<guest-directory...>
```

```
VBoxManage guestcontrol <uuid | vmname> rmdir [--domain=domainname]
[--passwordfile=password-file | --password=password] [--quiet] [--recursive]
[--username=username] [--verbose] <guest-directory...>
```

```
VBoxManage guestcontrol <uuid | vmname> rm [--domain=domainname]
[--force] [--passwordfile=password-file | --password=password] [--quiet]
[--username=username] [--verbose] <guest-directory...>
```

```
VBoxManage guestcontrol <uuid | vmname> mv [--domain=domainname]
[--passwordfile=password-file | --password=password] [--quiet]
[--username=username] [--verbose] <source...> <destination-directory>
```

```
VBoxManage guestcontrol <uuid | vmname> mktemp [--directory]
[--domain=domainname] [--mode=mode] [--passwordfile=password-file |
--password=password] [--quiet] [--secure] [--tmpdir=directory-name]
[--username=username] [--verbose] <template-name>
```

```
VBoxManage guestcontrol <uuid | vmname> fsinfo [--domain=domainname]
[--passwordfile=password-file | --password=password] [--human-readable]
[--quiet] [--total] [--username=username] [--verbose] <path>
```

```
VBoxManage guestcontrol <uuid | vmname> stat [--domain=domainname]
[--passwordfile=password-file | --password=password] [--quiet]
[--username=username] [--verbose] <filename>
```

```
VBoxManage guestcontrol <uuid | vmname> list <all | files | processes |
sessions> [--quiet] [--verbose]
```

```
VBoxManage guestcontrol <uuid | vmname> closeprocess [--session-id=ID |
--session-name=name-or-pattern] [--quiet] [--verbose] <PID...>
```

```
VBoxManage guestcontrol <uuid | vmname> closesession [--all |
--session-id=ID | --session-name=name-or-pattern] [--quiet] [--verbose]
```

```
VBoxManage guestcontrol <uuid | vmname> updatega [--quiet] [--verbose]
[--source=guest-additions.ISO] [--wait-start] [-- [argument...]]
```

```
VBoxManage guestcontrol <uuid | vmname> watch [--quiet] [--verbose]
```

Description

The `VBoxManage guestcontrol` command enables you to control a guest (VM) from the host system. See Guest Control of Applications.

Common Options and Operands

The following options can be used by any of the `VBoxManage guestcontrol` subcommands:

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or name of the VM.

`--quiet`
Specifies that the command produce quieter output.
The short form of this option is `-q`.

`--verbose`
Specifies that the command produce more detailed output.
The short form of this option is `-v`.

Some of the `VBoxManage guestcontrol` subcommands require that you provide guest credentials for authentication. The subcommands are: `copyfrom`, `copyto`, `fsinfo`, `mkdir`, `mktemp`, `mv`, `rmdir`, `rm`, `run`, `start`, and `stat`.

While you cannot perform anonymous executions, a user account password is optional and depends on the guest's OS security policy. If a user account does not have an associated password, specify an empty password. On OSes such as Windows, you might need to adjust the security policy to permit user accounts with an empty password. In additional, global domain rules might apply and therefore cannot be changed.

The following options are used for authentication on the guest VM:

`--domain=`*domainname*
Specifies the user domain for Windows guest VMs.

`--password=`*password*
Specifies the password for the specified user. If you do not specify a password on the command line or if the password file is empty, the specified user needs to have an empty password.

`--passwordfile=`*filename*
Specifies the absolute path to a file on the guest OS that contains the password for the specified user. If the password file is empty or if you do not specify a password on the command line, the specified user needs to have an empty password.

`--username=`*username*
Specifies an existing user on the guest OS that runs the process. If unspecified, the host user runs the process.

Guest Process Restrictions

By default, you can run up to five guest processes simultaneously. If a new guest process starts and would exceed this limit, the oldest not-running guest process is discarded to run the new process. You cannot retrieve output from a discarded guest process. If all five guest processes are active and running, attempting to start a new guest process fails.

You can modify the guest process execution limit in two ways:

- Use the `VBoxManage setproperty` command to update the `/VirtualBox/GuestAdd/VBoxService/--control-procs-max-kept` guest property value.
- Use the `VBoxService` command and specify the `--control-procs-max-kept=`*value* option.

After you change the limit, you must restart the guest OS.

You can serve an unlimited number guest processes by specifing a value of `0`, however this action is not recommended.

Run a Command on the guest

```
VBoxManage guestcontrol <uuid | vmname> run [--arg0=argument 0]
[--domain=domainname] [--dos2unix] [--exe=filename]
[--ignore-orphaned-processes] [--no-wait-stderr | --wait-stderr]
[--no-wait-stdout | --wait-stdout] [--passwordfile=password-file |
--password=password] [--profile] [--putenv=var-name=[value]] [--quiet]
[--timeout=msec] [--unix2dos] [--unquoted-args] [--username=username]
[--cwd=directory] [--verbose] <--[argument...]>
```

The `VBoxManage guestcontrol` *`vmname`* `run` command enables you to execute a program on the guest VM. Standard input, standard output, and standard error are redirected from the VM to the host system until the program completes.

> **Note:**
>
> The Windows OS imposes certain limitations for graphical applications. See Known Limitations.

`--exe=` ***path-to-executable***
Specifies the absolute path of the executable program to run on the guest VM. For example: `C:\Windows\System32\calc.exe`.

`--cwd=` ***path-to-directory***
Specifies the absolute path of a directory in which to start the program. Optional. The directory must exist and be accessible to the guest user. For example: `C:\Users\production\work_area`.
The short form of this option is `-C`.

`--timeout=` ***msec***
Specifies the maximum amount of time, in milliseconds, that the program can run. While the program runs, `VBoxManage` receives its output.
If you do not specify a timeout value, `VBoxManage` waits indefinitely for the process to end, or for an error to occur.

`--putenv=` ***NAME*** **`=[`** ***value*** **`]`**
Sets, modifies, and unsets environment variables in the guest VM environment.
When you create a guest process, it runs with the default standard guest OS environment. Use this option to modify environment variables in that default environment.
Use the `--putenv=`*`NAME`*`=[`*`value`*`]` option to set or modify the environment variable specified by *NAME*.
Use the `--putenv=`*`NAME`*`=[`*`value`*`]` option to unset the environment variable specified by *NAME*.
Ensure that any environment variable name or value that includes spaces is enclosed by quotes.
Specify a `--putenv` option for each environment variable that you want to modify.
The short form of this option is `-E`.

`--unquoted-args`
Disables the escaped double quoting of arguments that you pass to the program. For example, `\"fred\"`.

`--ignore-orphaned-processes`
Ignores orphaned processes. Not yet implemented.

`--profile`
Uses a shell profile to specify the environment to use. Not yet implemented.

`--no-wait-stdout`
Does not wait for the guest process to end or receive its exit code and any failure explanation.

`--wait-stdout`
Waits for the guest process to end to receive its exit code and any failure explanation. The `VBoxManage` command receives the standard output of the guest process while the process runs.

`--no-wait-stderr`
Does not wait for the guest process to end to receive its exit code, error messages, and flags.

`--wait-stderr`
Waits for the guest process to end to receive its exit code, error messages, and flags. The `VBoxManage` command receives the standard error of the guest process while the process runs.

`--dos2unix`
Transform DOS or Windows guest output to UNIX or Linux output. This transformation changes CR + LF line endings to LF. Not yet implemented.

`--unix2dos`
Transform UNIX or Linux guest output to DOS or Windows output. This transformation changes LF line endings to CR + LF.

`--[ argument ...]`
Specifies the name of the program and any arguments to pass to the program.
Ensure that any command argument that includes spaces is enclosed by quotes.

Start a Command on the guest

```
VBoxManage guestcontrol <uuid | vmname> start [--arg0=argument 0]
[--domain=domainname] [--exe=filename] [--ignore-orphaned-processes]
[--passwordfile=password-file | --password=password] [--profile]
[--putenv=var-name=[value]] [--quiet] [--timeout=msec] [--unquoted-args]
[--username=username] [--cwd=directory] [--verbose] <--[argument...]>
```

The `VBoxManage guestcontrol vmname start` command enables you to execute a guest program until it completes.

> **Note:**
>
> The Windows OS imposes certain limitations for graphical applications. See Known Limitations.

Copy a file from the guest to the host.

```
VBoxManage guestcontrol <uuid | vmname> copyfrom [--dereference]
[--domain=domainname] [--passwordfile=password-file | --password=password]
[--quiet] [--no-replace] [--recursive]
[--target-directory=host-destination-dir] [--update] [--username=username]
[--verbose] <guest-source0> guest-source1[...] <host-destination>
```

The `VBoxManage guestcontrol` *`vmname`* `copyfrom` command enables you to copy a file from the guest VM to the host system.

`--dereference`
Enables following of symbolic links on the guest file system.

`--no-replace`
Only copies a file if it does not exist on the host yet.
The short form of this option is `-n`.

`--recursive`
Recursively copies files and directories from the specified guest directory to the host.
The short form of this option is `-R`.

`--target-directory=` ***host-dst-dir***
Specifies the absolute path of the destination directory on the host system. For example, `C:\Temp`.

`--update`
Only copies a file if the guest file is newer than on the host.
The short form of this option is `-u`.

guest-source0 **`[`** ***guest-source1*** **`[...]]`**
Specifies the absolute path of one or more files to copy from the guest VM. For example, `C:\Windows\System32\calc.exe`. You can use wildcards to specify multiple files. For example, `C:\Windows\System*\*.dll`.

Copy a file from the host to the guest.

`VBoxManage guestcontrol` <*uuid* | *vmname*> `copyto [--dereference] [--domain=`*domainname*`] [--passwordfile=`*password-file* | `--password=`*password*`] [--quiet] [--no-replace] [--recursive] [--target-directory=`*guest-destination-dir*`] [--update] [--username=`*username*`] [--verbose]` <*host-source0*> *host-source1*`[...]`

The `VBoxManage guestcontrol` *`vmname`* `copyto` command enables you to copy a file from the host system to the guest VM.

`--dereference`
Enables following of symbolic links on the host system.

`--no-replace`
Only copies a file if it does not exist on the guest yet.
The short form of this option is `-n`.

`--recursive`
Recursively copies files and directories from the specified host directory to the guest.
The short form of this option is `-R`.

`--target-directory=` ***guest-dst-dir***
Specifies the absolute path of the destination directory on the guest. For example, `/home/myuser/fromhost`.

--update
Only copies a file if the host file is newer than on the guest.
The short form of this option is -u.

***host-source0* [*host-source1* [...]]**
Specifies the absolute path of a file to copy from the host system. For example, C:\Windows\System32\calc.exe. You can use wildcards to specify multiple files. For example, C:\Windows\System**.dll.

Show guest filesystem information.

```
VBoxManage guestcontrol <uuid | vmname> fsinfo [--domain=domainname]
[--passwordfile=password-file | --password=password] [--human-readable]
[--quiet] [--total] [--username=username] [--verbose] <path>
```

The VBoxManage guestcontrol *vmname* fsinfo command enables you to show filesystem information of the guest VM.

An alternate form of this subcommand is df.

--human-readable
Shows the disk sizes in a human readable form.

--total
Produces a grand total of all disk sizes.

***guest-path* [*guest-path* ...]**
Specifies an absolute path to show guest filesystem information for.

Create a directory on the guest.

```
VBoxManage guestcontrol <uuid | vmname> mkdir [--domain=domainname]
[--mode=mode] [--parents] [--passwordfile=password-file |
--password=password] [--quiet] [--username=username] [--verbose]
<guest-directory...>
```

The VBoxManage guestcontrol *vmname* mkdir command enables you to create one or more directories on the guest VM.

Alternate forms of this subcommand are md, createdir, and createdirectory.

--parents
Creates any of the missing parent directories of the specified directory.
For example, if you attempt to create the D:\Foo\Bar directory and the D:\Foo directory does not exist, using the --parents creates the missing D:\Foo directory. However, if you attempt to create the D:\Foo\Bar and do not specify the --parents option, the command fails.

`--mode=` *mode*
Specifies the permission mode to use for the specified directory. If you specify the `--parents` option, the mode is used for the associated parent directories, as well. *mode* is a four-digit octal mode such as `0755`.

***guest-dir* `[` *guest-dir* `...]`**
Specifies an absolute path of one or more directories to create on the guest VM. For example, `D:\Foo\Bar`.
If all of the associated parent directories do not exist on the guest VM, you must specify the `--parents` option.
You must have sufficient rights on the guest VM to create the specified directory and its parent directories.

Remove a directory from the guest.

```
VBoxManage guestcontrol <uuid | vmname> rmdir [--domain=domainname]
[--passwordfile=password-file | --password=password] [--quiet] [--recursive]
[--username=username] [--verbose] <guest-directory...>
```

The `VBoxManage guestcontrol` *vmname* `rmdir` command enables you to delete the specified directory from the guest VM.

Alternate forms of this subcommand are `removedir` and `removedirectory`.

`--recursive`
Recursively removes directories from the specified from the guest VM.
The short form of this option is `-R`.

***guest-dir* `[` *guest-dir* `...]`**
Specifies an absolute path of one or more directories to remove from the guest VM. You can use wildcards to specify the directory names. For example, `D:\Foo\*Bar`.
You must have sufficient rights on the guest VM to remove the specified directory and its parent directories.

Remove a file from the guest.

```
VBoxManage guestcontrol <uuid | vmname> rm [--domain=domainname]
[--force] [--passwordfile=password-file | --password=password] [--quiet]
[--username=username] [--verbose] <guest-directory...>
```

The `VBoxManage guestcontrol` *vmname* `rm` command enables you to delete the specified files from the guest VM.

The alternate form of this subcommand is `removefile`.

`--force`
Forces the operation and overrides any confirmation requests.
The short form of this option is `-f`.

***guest-file* [*guest-file* . . .]**
Specifies an absolute path of one or more file to remove from the guest VM. You can use wildcards to specify the file names. For example, `D:\Foo\Bar\text*.txt`.
You must have sufficient rights on the guest VM to remove the specified file.

Rename a file or Directory on the guest

```
VBoxManage guestcontrol <uuid | vmname> mv [--domain=domainname]
[--passwordfile=password-file | --password=password] [--quiet]
[--username=username] [--verbose] <source . . .> <destination-directory>
```

The `VBoxManage guestcontrol vmname mv` command enables you to rename files and directories on the guest VM.

Alternate forms of this subcommand are `move`, `ren`, and `rename`.

***guest-source* [*guest-source* . . .]**
Specifies an absolute path of a file or a single directory to move or rename on the guest VM. You can use wildcards to specify the file names.
You must have sufficient rights on the guest VM to access the specified file or directory.

dest
Specifies the absolute path of the renamed file or directory, or the destination directory to which to move the files. If you move only one file, *dest* can be a file or a directory, otherwise *dest* must be a directory.
You must have sufficient rights on the guest VM to access the destination file or directory.

Create a Temporary File or Directory on the guest

```
VBoxManage guestcontrol <uuid | vmname> mktemp [--directory]
[--domain=domainname] [--mode=mode] [--passwordfile=password-file |
--password=password] [--quiet] [--secure] [--tmpdir=directory-name]
[--username=username] [--verbose] <template-name>
```

The `VBoxManage guestcontrol vmname mktemp` command enables you to create a temporary file or temporary directory on the guest VM. You can use this command to assist with the subsequent copying of files from the host system to the guest VM. By default, this command creates the file or directory in the guest VM's platform-specific `temp` directory.

Alternate forms of this subcommand are `createtemp` and `createtemporary`.

`--directory`
Creates a temporary directory that is specified by the *template* operand.

`--secure`
Enforces secure file and directory creation by setting the permission mode to `0755`. Any operation that cannot be performed securely fails.

`--mode=` *mode*
Specifies the permission mode to use for the specified directory. *mode* is a four-digit octal mode such as `0755`.

`--tmpdir=` *directory*
Specifies the absolute path of the directory on the guest VM in which to create the specified file or directory. If unspecified, *directory* is the platform-specific `temp` directory.

template
Specifies a template file name for the temporary file, without a directory path. The template file name must contain at least one sequence of three consecutive X characters, or must end in X.

Show a file or File System Status on the guest

```
VBoxManage guestcontrol <uuid | vmname> stat [--domain=domainname]
[--passwordfile=password-file | --password=password] [--quiet]
[--username=username] [--verbose] <filename>
```

The `VBoxManage guestcontrol` *`vmname`* `stat` command enables you to show the status of files or file systems on the guest VM.

***file* `[` *file* `...]`**
Specifies an absolute path of a file or file system on the guest VM. For example, `/home/foo/a.out`.
You must have sufficient rights on the guest VM to access the specified files or file systems.

List the Configuration and Status Information for a Guest Virtual Machine

```
VBoxManage guestcontrol <uuid | vmname> list <all | files | processes |
sessions> [--quiet] [--verbose]
```

The `VBoxManage guestcontrol` *`vmname`* `list` command enables you to list guest control configuration and status information. For example, the output shows open guest sessions, guest processes, and files.

`all|sessions|processes|files`
Indicates the type of information to show. `all` shows all available data, `sessions` shows guest sessions, `processes` shows processes, and `files` shows files.

Terminate a Process in a guest Session

```
VBoxManage guestcontrol <uuid | vmname> closeprocess [--session-id=ID |
--session-name=name-or-pattern] [--quiet] [--verbose] <PID...>
```

The `VBoxManage guestcontrol` *`vmname`* `closeprocess` command enables you to terminate a guest process that runs in a guest session. Specify the process by using a process identifier (PID) and the session by using the session ID or name.

`--session-id=` ***ID***
Specifies the ID of the guest session.

`--session-name=` ***name*** **`|`** ***pattern***
Specifies the name of the guest session. Use a pattern that contains wildcards to specify multiple sessions.

PID **`[`** ***PID*** **`...]`**
Specifies the list of PIDs of guest processes to terminate.

Close a guest Session

```
VBoxManage guestcontrol <uuid | vmname> closesession [--all |
--session-id=ID | --session-name=name-or-pattern] [--quiet] [--verbose]
```

The `VBoxManage guestcontrol` *`vmname`* `closesession` command enables you to close a guest session. Specify the guest session either by session ID or by name.

`--session-id=` ***ID***
Specifies the ID of the guest session.

`--session-name=` ***name*** **`|`** ***pattern***
Specifies the name of the guest session. Use a pattern that contains wildcards to specify multiple sessions.

`--all`
Closes all guest sessions.

Update the Guest Additions Software on the guest

```
VBoxManage guestcontrol <uuid | vmname> updatega [--quiet] [--verbose]
[--source=guest-additions.ISO] [--wait-start] [-- [argument...]]
```

The `VBoxManage guestcontrol` *`vmname`* `updatega` command enables you to update the Guest Additions software installed in the specified guest VM.

Alternate forms of this subcommand are `updateadditions` and `updateguestadditions`.

`--source=` ***new-iso-path***
Specifies the absolute path of the Guest Additions update `.ISO` file on the guest VM.

`--reboot`
Automatically reboots the guest after a successful Guest Additions update.

`--timeout=` *ms*
Sets the timeout (in ms) to wait for the overall Guest Additions update to complete. By default no timeout is being used.

`--verify`
Verifies whether the Guest Additions were updated successfully after a successful installation. A guest reboot is mandatory.

`--wait-ready`
Waits for the current Guest Additions being ready to handle the Guest Additions update.

`--wait-start`
Starts the `VBoxManage` update process on the guest VM and then waits for the Guest Additions update to begin before terminating the `VBoxManage` process.
By default, the `VBoxManage` command waits for the Guest Additions update to complete before it terminates. Use this option when a running `VBoxManage` process affects the interaction between the installer and the guest OS.

`--` *argument* `[` *argument* `...]`
Specifies optional command-line arguments to pass to the Guest Additions updater. You might use the `--` option to pass the appropriate updater arguments to retrofit features that are not yet installed.
Ensure that any command argument that includes spaces is enclosed by quotes.

Wait for a guest run level

The `VBoxManage guestcontrol` *`vmname`* `waitrunlevel` command enables you to wait for a guest run level being reached.

`--timeout=` *ms*
Sets the timeout (in ms) to wait for reaching the run level. By default no timeout is being used.

system* | *userland* | *desktop
Specifies the run level to wait for.

Show Current Guest Control Activity

```
VBoxManage guestcontrol <uuid | vmname> watch [--quiet] [--verbose]
```

The `VBoxManage guestcontrol` *`vmname`* `watch` command enables you to show current guest control activity.

Examples

The following `VBoxManage guestcontrol run` command executes the `ls -l /usr` command on the `My OL VM` Oracle Linux VM as the `user1` user.

```
$ VBoxManage --nologo guestcontrol "My OL VM" run --exe "/bin/ls" \
--username user1 --passwordfile pw.txt --wait-stdout -- -l /usr
```

The `--exe` option specifies the absolute path of the command to run in the guest VM, `/bin/ls`. Use the `--` option to pass any arguments that follow it to the `ls` command.

Use the `--username` option to specify the user name, `user1` and use the `--passwordfile` option to specify the name of a file that includes the password for the `user1` user, `pw.txt`.

The `--wait-stdout` option waits for the `ls` guest process to complete before providing the exit code and the command output. The `--nologo` option suppresses the output of the logo information.

The following `VBoxManage guestcontrol run` command executes the `ipconfig` command on the `My Win VM` Windows VM as the `user1` user. Standard input, standard output, and standard error are redirected from the VM to the host system until the program completes.

```
$ VBoxManage --nologo guestcontrol "My Win VM" run \
--exe "c:\\windows\\system32\\ipconfig.exe" \
--username user1 --passwordfile pw.txt --wait-stdout
```

The `--exe` specifies the absolute path of command to run in the guest VM, `c:\windows\system32\ipconfig.exe`. The double backslashes shown in this example are required only on UNIX host systems.

Use the `--username` option to specify the user name, `user1` and use the `--passwordfile` option to specify the name of a file that includes the password for the `user1` user, `pw.txt`.

The `--wait-stdout` option waits for the `ls` guest process to complete before providing the exit code and the command output. The `--nologo` option to suppress the output of the logo information.

The following `VBoxManage guestcontrol start` command executes the `ls -l /usr` command on the `My OL VM` Oracle Linux VM until the program completes.

```
$ VBoxManage --nologo guestcontrol "My Win VM" start \
--exe "c:\\windows\\system32\\ipconfig.exe" \
--username user1 --passwordfile pw.txt
```

The following `VBoxManage guestcontrol run` command executes a `/usr/bin/busybox -l /usr` command on the `My OL VM` Oracle Linux VM as the `user1` user, explicitly using `ls` as argument 0.

```
$ VBoxManage --nologo guestcontrol "My OL VM" run --exe "/usr/bin/busybox" \
--username user1 --passwordfile pw.txt --wait-stdout --arg0 ls -- -l /usr
```

The `--exe` option specifies the absolute path of the command to run in the guest VM, `/usr/bin/busybox`. Use the `--` option to pass any arguments that follow it to the `busybox` command.

Use the `--username` option to specify the user name, `user1` and use the `--passwordfile` option to specify the name of a file that includes the password for the `user1` user, `pw.txt`.

The `--wait-stdout` option waits for the `ls` guest process to complete before providing the exit code and the command output. The `--nologo` option suppresses the output of the logo information.

The `--arg0` option explicitly specifies the argument 0 to use for the command to execute.

> **Note:**
>
> If this option is not set, argument 0 will be taken from the value of `--exe`, or, if `--exe` is also not set, the first value passed after `--`.
>
> Use `--verbose` to see the effective command line passed to the guest.

The default behavior of argument 0 is to either use the value from `--exe`, or, if not set, the first value passed after `--`.

VBoxManage guestproperty

Manage virtual machine guest properties

Synopsis

```
VBoxManage guestproperty get <uuid | vmname> <property-name> [--verbose]
```

```
VBoxManage guestproperty enumerate <uuid | vmname> [--no-timestamp]
[--no-flags] [--relative] [--old-format] [patterns...]
```

```
VBoxManage guestproperty set <uuid | vmname> <property-name> [property-value
[--flags=flags]]
```

```
VBoxManage guestproperty unset <uuid | vmname> <property-name>
```

```
VBoxManage guestproperty wait <uuid | vmname> <patterns> [--timeout=msec]
[--fail-on-timeout]
```

Description

The `VBoxManage guestproperty` command enables you to set or retrieve the properties of a running virtual machine (VM). See Guest Properties. Guest properties are arbitrary name-value string pairs that can be written to and read from by either the guest or the host. As a result, these properties can be used as a low-volume communication channel for strings

provided that a guest is running and has the Guest Additions installed. In addition, the Guest Additions automatically set and maintain values whose keywords begin with `/VirtualBox/`.

General Command Operand

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or name of the VM.

List All Properties for a Virtual Machine

```
VBoxManage guestproperty enumerate <uuid | vmname> [--no-timestamp]
[--no-flags] [--relative] [--old-format] [patterns...]
```

The `VBoxManage guestproperty enumerate` command lists each guest property and value for the specified VM. Note that the output is limited if the guest's service is not updating the properties, for example because the VM is not running or because the Guest Additions are not installed.

`--relative`
Display the timestamp relative to current time.

`--no-timestamp`
Do not display the timestamp of the last update.

`--no-flags`
Do not display the flags.

`--old-format`
Use the output format from VirtualBox 6.1 and earlier.

pattern
Filters the list of properties based on the specified pattern, which can contain the following wildcard characters:

`*` (asterisk)
Represents any number of characters. For example, the `/VirtualBox*` pattern matches all properties that begin with `/VirtualBox`.

`?` (question mark)
Represents a single arbitrary character. For example, the `fo?` pattern matches both `foo` and `for`.

`|` (pipe)
Specifies multiple alternative patterns. For example, the `s*|t*` pattern matches any property that begins with `s` or `t`.

Retrieve a Property Value for a Virtual Machine

```
VBoxManage guestproperty get <uuid | vmname> <property-name> [--verbose]
```

The `VBoxManage guestproperty get` command retrieves the value of the specified property. If the property cannot be found, for example because the guest is not running, the command issues the following message:

```
No value set!
```

property-name
Specifies the name of the property.

`--verbose`
Provides the property value, timestamp, and any specified value attributes.

Set a Property Value for a Virtual Machine

```
VBoxManage guestproperty set <uuid | vmname> <property-name> [property-value
[--flags=flags]]
```

The `VBoxManage guestproperty set` command enables you to set a guest property by specifying the property and its value. If you omit the value, the property is deleted.

property-name
Specifies the name of the property.

property-value
Specifies the value of the property. If no value is specified, any existing value is removed.

`--flags=` ***flags***
Specify the additional attributes of the value. The following attributes can be specified as a comma-separated list:

`TRANSIENT`
Removes the value with the VM data when the VM exits.

`TRANSRESET`
Removes the value when the VM restarts or exits.

`RDONLYGUEST`
Specifies that the value can be changed only by the host and that the guest can read the value.

`RDONLYHOST`
Specifies that the value can be changed only by the guest and that the host can read the value.

`READONLY`
Specifies that the value cannot be changed.

Wait for a Property Value to Be Created, Deleted, or Changed

```
VBoxManage guestproperty wait <uuid | vmname> <patterns> [--timeout=msec]
[--fail-on-timeout]
```

The `VBoxManage guestproperty wait` command waits for a particular value that is described by the pattern string to change, to be deleted, or to be created.

patterns
Specifies a pattern that matches the properties on which you want to wait. For information about the pattern wildcards, see the description of the `--patterns` option.

`--timeout` ***msec***
Specifies the number of microseconds to wait.

`--fail-on-timeout`
Specifies that the command fails if the timeout is reached.

Unset a Virtual Machine Property Value

```
VBoxManage guestproperty unset <uuid | vmname> <property-name>
```

The `VBoxManage guestproperty unset` command unsets the value of a guest property.

The alternate form of this subcommand is `delete`.

property-name
Specifies the name of the property.

Examples

The following command lists the guest properties and their values for the `win8` VM.

```
$ VBoxManage guestproperty enumerate win8
```

The following command creates a guest property called `region` for the `win8` VM. The value of the property is set to `west`.

```
$ VBoxManage guestproperty set win8 region west
```

VBoxManage hostonlyif

Manage host-only network interfaces

Synopsis

```
VBoxManage hostonlyif ipconfig <ifname> [--dhcp | --ip=IPv4-address
--netmask=IPv4-netmask | --ipv6=IPv6-address --netmasklengthv6=length]
```

```
VBoxManage hostonlyif create
```

```
VBoxManage hostonlyif remove <ifname>
```

Description

The `VBoxManage hostonlyif` command enables you to change the IP configuration of a host-only network interface. For a description of host-only networking, see Host-Only Networking. Each host-only network interface is identified by a name and can either use the internal DHCP server or a manual IP configuration, both IPv4 and IPv6.

Configure a Host-Only Interface

```
VBoxManage hostonlyif ipconfig <ifname> [--dhcp | --ip=IPv4-address
--netmask=IPv4-netmask | --ipv6=IPv6-address --netmasklengthv6=length]
```

The `VBoxManage hostonlyif ipconfig` command configures a host-only interface.

ifname
Specifies the name of the network interface. The name is of the form `vboxnet`*N* where *N* is the interface instance.

`--dhcp`
Uses DHCP for the network interface.
You cannot use this option with the `--ip`, `--ipv6`, `--netmask`, and `--netmasklengthv6` options.

`--ip=` *IPv4-address*
Specifies the IPv4 IP address for the network interface.
You cannot use this option with the `--dhcp`, `--ipv6`, and `--netmasklengthv6` options.

`--netmask=` *IPv4-netmask*
Specifies the IPv4 netmask of the network interface. The default value is `255.255.255.0`.
You can use this option only with the `--ip` option.

`--ipv6=` *IPv6-address*
Specifies the IPv6 IP address for the network interface.
You cannot use this option with the `--dhcp`, `--ip`, and `--netmask` options.

`--netmasklengthv6=` *length*
Specifies the length of the IPv6 network interface. The default value is `64`.
You can use this option only with the `--ipv6` option.

Create a Network Interface on the Host System

```
VBoxManage hostonlyif create
```

The `VBoxManage hostonlyif create` command creates a new host-only network interface on the host operating system (OS). The network interface name is of the form

`vboxnet`*N* where *N* is the interface instance. You must run this command before you can attach virtual machines (VMs) to the host-only network.

Remove a Network Interface From the Host System

```
VBoxManage hostonlyif remove <ifname>
```

The `VBoxManage hostonlyif remove` command removes the specified host-only network interface from the host OS.

ifname
Specifies the name of the network interface. The name is of the form `vboxnet`*N* where *N* is the interface instance.

Examples

The following command creates a new host-only network interface.

```
$ VBoxManage hostonlyif create
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
Interface 'vboxnet2' was successfully created
```

The following command configures the IPv4 address for the `vboxnet2` host-only network interface.

```
$ VBoxManage hostonlyif ipconfig vboxnet2 --ip 10.0.2.18
```

VBoxManage hostonlynet

Host Only Network management

Synopsis

```
VBoxManage hostonlynet add <--name=netname> [--id=netid] <--netmask=mask>
<--lower-ip=address> <--upper-ip=address> [--enable | --disable]
```

```
VBoxManage hostonlynet modify <--name=netname | --id=netid>
[--lower-ip=address] [--upper-ip=address] [--netmask=mask] [--enable |
--disable]
```

```
VBoxManage hostonlynet remove <--name=netname | --id=netid>
```

Description

The `hostonlynet` commands enable you to control host-only networks.

Common options

The subcommands of `hostonlynet` all operate on an host-only network that can be identified via its name or uuid:

--name=*netname*
The host-only network name. You see it as VBoxNetworkName in the output from `VBoxManage list hostonlynets`.

--id=*netid*
The host-only network uuid. If not specified when adding a new network, one will be generated automatically.

hostonlynet add

```
VBoxManage hostonlynet add <--name=netname> [--id=netid] <--netmask=mask>
<--lower-ip=address> <--upper-ip=address> [--enable | --disable]
```

Adds a new host-only network.

Options configuring the host-only network:

`--netmask=` *mask*
The network mask. Typically 255.255.255.0.

`--lower-ip=`*address*, `--upper-ip=`*address*
The IP address range for handing out via DHCP. The upper boundrary is inclusive while the lower one is not, so the upper address will be handed out to a client, while the lower address will be used by the host itself.

`--enable`, --disable
Whether to enable the host-only network or disable it. If not specified, the network will be created in enabled state.

hostonlynet modify

```
VBoxManage hostonlynet modify <--name=netname | --id=netid>
[--lower-ip=address] [--upper-ip=address] [--netmask=mask] [--enable |
--disable]
```

This modifies an existing host-only network configuration. It takes the same options as the `add` command.

hostonlynet remove

```
VBoxManage hostonlynet remove <--name=netname | --id=netid>
```

Removes the specified host-only network.

VBoxManage import

Import a virtual appliance in OVF format or from a cloud service and create virtual machines

Synopsis

```
VBoxManage import <ovfname | ovaname> [--dry-run] [--options=keepallmacs
| keepnatmacs | importtovdi] [--vsys=n] [--ostype=ostype] [--vmname=name]
[--settingsfile=file] [--basefolder=folder] [--group=group] [--memory=MB]
[--cpus=n] [--description=text] [--eula=show | accept] [--unit=n]
[--ignore] [--scsitype=BusLogic | LsiLogic] [--disk=path]
[--controller=index] [--port=n]
```

```
VBoxManage import OCI:// --cloud [--ostype=ostype] [--vmname=name]
[--basefolder=folder] [--memory=MB] [--cpus=n] [--description=text]
<--cloudprofile=profile> <--cloudinstanceid=id> [--cloudbucket=bucket]
```

Description

The `VBoxManage import` command imports a virtual appliance either in OVF format or from a cloud service such as Oracle Cloud Infrastructure. The import is performed by copying virtual disk images (by default using the VMDK image format) and by creating virtual machines (VMs) in Oracle VM VirtualBox. See Importing and Exporting Virtual Machines.

You must specify the path name of an OVF file or OVA archive to use as input, or a placeholder for the cloud case. For OVF appliances ensure that any disk images are in the same directory as the OVF file.

Note that any options you specify to control the imported virtual appliance or to modify the import parameters rely on the contents of the OVF file or the information from the cloud service.

Before you use the import operation to create the VM, perform a dry run to verify the correctness of your configuration. This is more useful with an OVF or OVA appliance, because with a cloud service even a dry run needs to perform most of the time consuming steps.

The import from a cloud service downloads a temporary file containing both the boot image and some metadata describing the details of the VM instance. The temporary file is deleted after successful import.

Common Options

ovfname* | *ovaname
Specifies the name of the OVF file or OVA archive that describes the appliance. In the cloud case this is usually a fixed string such as `OCI://`.

`--dry-run`
Performs a dry run of the `VBoxManage import` command before you perform the actual import operation. A dry run operation does the following:

- Outputs a description of the appliance's contents based on the specified OVF or OVA file.
- Shows how the appliance would be imported into Oracle VM VirtualBox. In addition, the output shows any options that you can use to change the import behavior.

The shortened form of this option is `-n`.

`--options=keepallmacs | keepnatmacs | importtovdi`
Enables you to fine tune the import operation.
Valid arguments are as follows:

- `keepallmacs`: Specifies that the MAC addresses of every virtual network card are left unchanged.
- `keepnatmacs`: Specifies that the MAC addresses of every virtual network card are left unchanged if the network type is NAT.
- `importtovdi`: Specifies that all new disk images are in VDI file format.

`--ostype=` *ostype*
Specifies the guest operating system (OS) information for the VM. Use the `VBoxManage list ostypes` command to view the OS type identifiers.

`--vmname=` *name*
Specifies the name of the VM to be used by Oracle VM VirtualBox.

`--basefolder=` *folder*
Specifies the folder where the files of the imported VM are stored.

`--memory=` *MB*
Specifies the memory size in Megabytes for the imported VM.

`--cpus=` *n*
Specifies the number of CPUs for the imported VM.

`--description=` *text*
Specifies the description text visible in the GUI and CLI when checking the VM details.

OVF / OVA Import Options

The following options are specific for importing a virtual appliance in OVF or OVA format. Such an appliance can contain one or more VMs, which requires specifying which VM configuration should be adjusted in case you want to change it. See Importing an Appliance in OVF Format.

`VBoxManage import <`*ovfname* `|` *ovaname*`> [--dry-run] [--options=keepallmacs | keepnatmacs | importtovdi] [--vsys=`*n*`] [--ostype=`*ostype*`] [--vmname=`*name*`] [--settingsfile=`*file*`] [--basefolder=`*folder*`] [--group=`*group*`] [--memory=`*MB*`] [--cpus=`*n*`] [--description=`*text*`] [--eula=show | accept] [--unit=`*n*`]`

```
[--ignore] [--scsitype=BusLogic | LsiLogic] [--disk=path]
[--controller=index] [--port=n]
```

`--vsys=` *`n`*
Specifies the index selecting a specific VM within the appliance. Affects the following options.

`--unit=` *`n`*
Specifies the index selecting a specific unit of a VM within the appliance. Affects the following options.

`--settingsfile=` *`file`*
Specifies the name (with or without path) of the VM config file which will be created as part of the import. Usually the preferred way is overriding the VM name with `--vmname` and if necessary specify the folder in which to create the VM with `--basefolder`.

`--group=` *`group`*
Specifies the primary group of the imported VM.

`--eula=show | accept`
Enables you to show or accept the license conditions of a VM within the appliance, Valid arguments are as follows:

- `show`: Shows the EULA of a VM.
- `accepts`: Accepts the EULA of a VM. Any VMs in an appliance which have an EULA require accepting it, otherwise the import will fail.

`--ignore`
Ignores the current unit of an imported VM, effectively removing the associated hardware.

`--scsitype=BusLogic | LsiLogic`
Enables you to select the type of the SCSI controller for the current unit of an imported VM. Valid arguments are as follows:

- `BusLogic`: Uses the (very old) BusLogic SCSI controller type.
- `LsiLogic`: Uses the (more modern) LsiLogic SCSI controller type.

Cloud Import Options

The following options are specific for importing a VM instance from a cloud service provider. It always deals with a single VM. See Importing an Instance from Oracle Cloud Infrastructure.

```
VBoxManage import OCI:// --cloud [--ostype=ostype] [--vmname=name]
[--basefolder=folder] [--memory=MB] [--cpus=n] [--description=text]
<--cloudprofile=profile> <--cloudinstanceid=id> [--cloudbucket=bucket]
```

`--cloud`
Specifies that the import should be from the cloud.

`--cloudprofile=` *`profile`*
Specifies the cloud profile which is used to connect to the cloud service provider. The cloud profile contains your Oracle Cloud Infrastructure account details, such as your user OCID and

the fingerprint for your public key. To use a cloud profile, you must have the required permissions on Oracle Cloud Infrastructure.

`--cloudinstanceid=` *id*
Specifies the ID of an existing instance in the cloud.

`--cloudbucket=` *bucket*
Specifies the bucket name in which to store the object created from the instance. In Oracle Cloud Infrastructure, a bucket is a logical container for storing objects. By default the first bucket available with the cloud profile is used.

Examples

The following example performs the dry run of an OVF import operation for a sample appliance that contains a Windows 10 guest:

```
$ VBoxManage import Windows10.ovf --dry-run
Interpreting Windows10.ovf...
OK.
Virtual system 0:
 0: Suggested OS type: "Windows10_64"
    (change with "--vsys 0 --ostype <type>"; use "list ostypes" to list all)
 1: Suggested VM name "win10-appliance"
    (change with "--vsys 0 --vmname <name>")
 2: Suggested VM group "/"
    (change with "--vsys 0 --group <group>")
 3: Suggested VM settings file name "/home/user1/VirtualBox VMs/win10-appliance/win10-
appliance.vbox"
    (change with "--vsys 0 --settingsfile <filename>")
 4: Suggested VM base folder "/home/user1/VirtualBox VMs"
    (change with "--vsys 0 --basefolder <path>")
 5: End-user license agreement
    (display with "--vsys 0 --eula show";
    accept with "--vsys 0 --eula accept")
 6: Number of CPUs: 1
    (change with "--vsys 0 --cpus <n>")
 7: Guest memory: 2048 MB (change with "--vsys 0 --memory <MB>")
 8: Sound card (appliance expects "ensoniq1371", can change on import)
    (disable with "--vsys 0 --unit 8 --ignore")
 9: USB controller
    (disable with "--vsys 0 --unit 9 --ignore")
10: Network adapter: orig bridged, config 2, extra type=bridged
11: Floppy
    (disable with "--vsys 0 --unit 11 --ignore")
12: SCSI controller, type BusLogic
    (change with "--vsys 0 --unit 12 --scsitype {BusLogic|LsiLogic}";
    disable with "--vsys 0 --unit 12 --ignore")
13: IDE controller, type PIIX4
    (disable with "--vsys 0 --unit 13 --ignore")
14: Hard disk image: source image=Windows10.vmdk,
      target path=/home/user1/disks/Windows10.vmdk, controller=12;channel=0
    (change target path with "--vsys 0 --unit 14 --disk <path>";
    change controller with "--vsys 0 --unit 14 --controller <index>";
    change controller port with "--vsys 0 --unit 14 --port <n>";
    disable with "--vsys 0 --unit 14 --ignore")
```

The dry run output lists and numbers the individual configuration items that are described in the `Windows10.ovf` file. Some of the items include information about how to disable or change the configuration of the item.

You can disable many of the items by using the `--vsys` *X* `--unit` *Y* `--ignore` options. *X* is the number of the virtual system. The value is `0` unless the appliance includes several virtual system descriptions. *Y* is the configuration item number.

Item 1 in the example command output specifies the name of the target machine. Items 12 and 13 specify the IDE and SCSI hard disk controllers, respectively.

Item 14 indicates the hard disk image and the `--disk` option specifies the target path where the image will be stored, the `--controller` option specifies which controller the disk will be attached to, and the `--port` option specifies which port on the controller the disk will be attached to. The default values are specified in the OVF file.

You can combine several items for the same virtual system by specifying the same value for the `--vsys` option. For example use the following command to import a machine as described in the OVF, exclude the sound card and USB controller and specify that the disk image is stored with a different name.

```
$ VBoxManage import Windows10.ovf --vsys 0 --unit 8 --ignore \
  --unit 9 --ignore --unit 14 --disk Windows10_disk0.vmdk
```

The following example illustrates how to import a VM from Oracle Cloud Infrastructure. To find the Oracle Cloud Infrastructure VM instances and its ID you can list all available instances with:

```
$ VBoxManage cloud --provider=OCI --profile=cloud-profile-name list instances
```

Once you know the ID the following command imports the instance from Oracle Cloud Infrastructure:

```
$ VBoxManage import OCI:// --cloud --vmname OCI_FreeBSD_VM --memory 4000 \
  --cpus 3 --ostype FreeBSD_64 --cloudprofile "standard user" \
  --cloudinstanceid ocid1.instance.oc1.iad.abuwc... --cloudbucket myBucket
```

VBoxManage list

View system information and VM configuration details

Synopsis

```
VBoxManage list [--long] [--sorted] [bridgedifs | cloudnets |
cloudprofiles | cloudproviders | cpu-profiles | dhcpservers | dvds |
extpacks | floppies | groups | hddbackends | hdds | hostcpuids |
hostdrives | hostdvds | hostfloppies | hostinfo | hostonlyifs |
hostonlynets | intnets | natnets | ostypes | runningvms |
screenshotformats | systemproperties | usbfilters | usbhost | vms |
webcams]
```

Description

The `VBoxManage list` subcommands enable you to obtain information about the Oracle VM VirtualBox software, the VMs and associated services that you create.

Common Options

`--long`
Shows detailed information about each information entry if available. The short form of this option is `-l`.

`--sorted`
Sorts the list of information entries alphabetically. The short form of this option is `-s`.

List the Bridged Network Interfaces on the Host System

```
VBoxManage list bridgedifs
```

The `VBoxManage list bridgedifs` command lists the bridged network interfaces that are currently available on the host system. The output shows detailed configuration information about each interface. See Virtual Networking.

List the Cloud Network Interfaces

```
VBoxManage list cloudnets
```

The `VBoxManage list cloudnets` command lists the cloud network interfaces that have been configured. A cloud network interface provides connectivity between local VMs and a cloud network.

List the Cloud Profiles

```
VBoxManage list cloudprofiles
```

The `VBoxManage list cloudprofiles` command lists the cloud profiles that have been configured. A cloud profile contains settings for a cloud service account.

List the Cloud Providers

```
VBoxManage list cloudproviders
```

The `VBoxManage list cloudproviders` command lists the cloud providers that are supported by Oracle VM VirtualBox. Oracle Cloud Infrastructure is an example of a cloud provider.

List the known CPU Profiles

```
VBoxManage list cpu-profiles
```

The `VBoxManage list cpu-profiles` command lists the CPU profiles that are known by Oracle VM VirtualBox.

List the DHCP Servers on the Host System

```
VBoxManage list dhcpservers
```

The `VBoxManage list dhcpservers` command lists the DHCP servers that are currently available on the host system. The output shows detailed configuration information about each DHCP server. See Virtual Networking.

List the DVD Virtual Disk Images

```
VBoxManage list dvds
```

The `VBoxManage list dvds` command shows information about the DVD virtual disk images that are currently in use by the Oracle VM VirtualBox software. For each image, the output shows all the settings, the UUIDs associated with the image by Oracle VM VirtualBox, and all files associated with the image.

This command performs the same function as the Virtual Media Manager. See The Virtual Media Manager.

List the Installed Oracle VM VirtualBox Extension Packs

```
VBoxManage list extpacks
```

The `VBoxManage list extpacks` command shows all Oracle VM VirtualBox extension packs that are currently installed. See Installing Oracle VM VirtualBox and Extension Packs and VBoxManage extpack.

List the Floppy Disk Virtual Disk Images

```
VBoxManage list floppies
```

The `VBoxManage list floppies` command shows information about the floppy disk images that are currently in use by the Oracle VM VirtualBox software. For each image, the output shows all the settings, the UUIDs associated with the image by Oracle VM VirtualBox, and all files associated with the image.

This command performs the same function as the Virtual Media Manager. See The Virtual Media Manager.

List the Virtual Machine Groups

```
VBoxManage list groups
```

The `VBoxManage list groups` command shows all VM groups. See Using VM Groups.

List the Virtual Disk Backends

```
VBoxManage list hddbackends
```

The `VBoxManage list hddbackends` command lists all known virtual disk backends of the Oracle VM VirtualBox software. For each such format, such as VDI, VMDK, or RAW, this command lists the backend's capabilities and configuration.

List the Hard Disk Virtual Disk Images

```
VBoxManage list hdds
```

The `VBoxManage list hdds` command shows information about the hard disk virtual disk images that are currently in use by the Oracle VM VirtualBox software. For each image, the output shows all the settings, the UUIDs associated with the image by Oracle VM VirtualBox, and all files associated with the image.

This command performs the same function as the Virtual Media Manager. See The Virtual Media Manager.

List the CPUID Information for the Host System CPUs

```
VBoxManage list hostcpuids
```

The `VBoxManage list hostcpuids` command lists CPUID information for each CPU on the host system. Use this information to perform a more fine grained analyis of the host system's virtualization capabilities.

List the Storage Drives on the Host System

```
VBoxManage list hostdrives
```

The `VBoxManage list hostdrives` command lists the disk drives on the host system potentially useful for creating a VMDK raw disk image. Each entry includes the name used to reference them from within Oracle VM VirtualBox.

List the DVD Drives on the Host System

```
VBoxManage list hostdvds
```

The `VBoxManage list hostdvds` command lists the DVD drives on the host system. Each DVD entry includes the name used to access them from within Oracle VM VirtualBox.

List the Floppy Disk Drives on the Host System

```
VBoxManage list hostfloppies
```

The `VBoxManage list hostfloppies` command lists the floppy disk drives on the host system. Each floppy disk entry includes the name used to access them from within Oracle VM VirtualBox.

List Information About the Host System

```
VBoxManage list hostinfo
```

The `VBoxManage list hostinfo` command shows information about the host system. The output includes information about the CPUs, memory, and the OS version.

List the Host-Only Network Interfaces on the Host System

```
VBoxManage list hostonlyifs
```

The `VBoxManage list hostonlyifs` command lists the host-only network interfaces that are currently available on the host system. The output shows detailed configuration information about each interface. See Virtual Networking.

List Host-Only Networks

```
VBoxManage list hostonlynets
```

The `VBoxManage list hostonlynets` command lists the host-only networks that have been configured. A host-only network provides connectivity between the host and local VMs. See Virtual Networking.

List Internal Networks

```
VBoxManage list intnets
```

The `VBoxManage list intnets` command shows information about the internal networks. See Virtual Networking.

List the NAT Network Interfaces on the Host System

```
VBoxManage list natnets
```

The `VBoxManage list natnets` command lists the NAT network interfaces that are currently available on the host system. See Virtual Networking.

List the Guest Operating Systems

```
VBoxManage list ostypes
```

The `VBoxManage list ostypes` command lists all guest operating systems (OSes) that are known to Oracle VM VirtualBox. Each OS entry includes an identifier, a description, a family identifier, a family description, and whether the OS has 64-bit support.

You can use these identifiers with the `VBoxManage modifyvm` command.

List the Running Virtual Machines

```
VBoxManage list runningvms
```

The `VBoxManage list runningvms` command lists all virtual machines (VMs) that are currently running. By default this displays a compact list that shows the name and UUID of each VM.

List the Available Screen Shot Formats

```
VBoxManage list screenshotformats
```

The `VBoxManage list screenshotformats` command shows the list of available screen shot formats.

List System Properties

```
VBoxManage list systemproperties
```

The `VBoxManage list systemproperties` command shows a large collection of global Oracle VM VirtualBox settings and limits, such as minimum and maximum guest RAM, virtual hard disk size, folder settings, and the current authentication library in use.

List the Registered Global USB Filters

```
VBoxManage list usbfilters
```

The `VBoxManage list usbfilters` command lists all global USB filters registered with Oracle VM VirtualBox and displays the filter parameters. Global USB filters are for devices which are accessible to all virtual machines.

List the USB Devices on the Host System

```
VBoxManage list usbhost
```

The `VBoxManage list usbhost` command shows information about the USB devices that are attached to the host system. The output includes information that you can use to construct USB filters and indicates whether the device is currently in use by the host system.

List Virtual Machines

```
VBoxManage list vms
```

The `VBoxManage list vms` command lists all virtual machines (VMs) that are currently registered with Oracle VM VirtualBox. By default this command displays a compact list that shows the name and UUID of each VM.

List the Webcams Attached to a Running Virtual Machine

```
VBoxManage list webcams
```

The `VBoxManage list webcams` command shows the list of webcams that are attached to the running VM.

The output is a list of absolute paths or aliases that are used to attach the webcams to the VM by using the `VBoxManage webcam attach` command.

Examples

The following command lists the VM groups configured for Oracle VM VirtualBox.

```
$ VBoxManage list groups
"/Linux-VMs"
"/Windows-VMs"
```

The following command lists the VMs that are currently running.

```
$ VBoxManage list runningvms
"ol7" {ol7-UUID}
"win8" {win8-UUID}
```

VBoxManage mediumio

Medium content access

Synopsis

```
VBoxManage mediumio <--disk=uuid|filename | --dvd=uuid|filename | --floppy=uuid|
filename> [--password-file=-|filename] formatfat [--quick]
```

```
VBoxManage mediumio <--disk=uuid|filename | --dvd=uuid|filename | --floppy=uuid|
filename> [--password-file=-|filename] cat [--hex] [--offset=byte-offset]
[--size=bytes] [--output=-|filename]
```

```
VBoxManage mediumio <--disk=uuid|filename | --dvd=uuid|filename | --floppy=uuid|
filename> [--password-file=-|filename] stream [--format=image-format]
[--variant=image-variant] [--output=-|filename]
```

Description

Common options

The subcommands of `mediumio` all operate on a medium which need to be specified, optionally with an encryption password. The following common options can be placed before or after the sub-command:

--disk=*uuid*|*filename*
Either the UUID or filename of a harddisk image, e.g. VDI, VMDK, VHD, ++.

--dvd=*uuid*|*filename*
Either the UUID or filename of a DVD image, e.g. ISO, DMG, CUE.

--floppy=*uuid*|*filename*
Either the UUID or filename of a floppy image, e.g. IMG.

--password-file=-|*filename*
The name of a file containing the medium encryption password. If – is specified, the password will be read from stdin.

mediumio formatfat

`VBoxManage mediumio` <`--disk=`*uuid*|*filename* | `--dvd=`*uuid*|*filename* | `--floppy=`*uuid*|*filename*> `[--password-file=-|`*filename*`] formatfat [--quick]`

Formats a floppy medium with the FAT file system. This will erase the content of the medium.

`--quick`
Quickformat the medium.

mediumio cat

`VBoxManage mediumio` <`--disk=`*uuid*|*filename* | `--dvd=`*uuid*|*filename* | `--floppy=`*uuid*|*filename*> `[--password-file=-|`*filename*`] cat [--hex] [--offset=`*byte-offset*`] [--size=`*bytes*`] [--output=-|`*filename*`]`

Dumps the medium content to stdout or the specified file.

`--hex`
Dump as hex bytes.

`--offset`
The byte offset in the medium to start.

`--size`
The number of bytes to dump.

--output
The output filename. As usual - is take to mean stdout.

mediumio stream

```
VBoxManage mediumio <--disk=uuid|filename | --dvd=uuid|filename | --floppy=uuid|
filename> [--password-file=-|filename] stream [--format=image-format]
[--variant=image-variant] [--output=-|filename]
```

Converts the medium to a streamable format and dumps it to the given output.

--format
The format of the destination image.

--variant
The medium variant for the destination.

--output
The output filename. As usual - is take to mean stdout.

VBoxManage mediumproperty

Manage medium properties

Synopsis

```
VBoxManage mediumproperty [disk | dvd | floppy] set <uuid | filename>
<property-name> <property-value>
```

```
VBoxManage mediumproperty [disk | dvd | floppy] get <uuid | filename>
<property-name>
```

```
VBoxManage mediumproperty [disk | dvd | floppy] delete <uuid | filename>
<property-name>
```

Description

The `VBoxManage mediumproperty` command enables you to set, retrieve, or delete a medium property.

Set a Medium Property

```
VBoxManage mediumproperty [disk | dvd | floppy] set <uuid | filename>
<property-name> <property-value>
```

The `VBoxManage mediumproperty set` command enables you to set a medium property.

`disk | dvd | floppy`
Specifies the type of medium. Valid values are `disk` (hard drive), `dvd`, or `floppy`.

uuid | filename
Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.

property-name
Specifies the name of the property.

property-value
Specifies the value of the specified property.

Retrieve a Medium Property Value

```
VBoxManage mediumproperty [disk | dvd | floppy] get <uuid | filename>
<property-name>
```

The `VBoxManage mediumproperty get` command enables you to retrieve the value of a medium property.

`disk | dvd | floppy`
Specifies the type of medium. Valid values are `disk` (hard drive), `dvd`, or `floppy`.

uuid | filename
Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.

property-name
Specifies the name of the property.

Delete a Medium Property

```
VBoxManage mediumproperty [disk | dvd | floppy] delete <uuid | filename>
<property-name>
```

The `VBoxManage mediumproperty delete` command enables you to delete a medium property.

`disk | dvd | floppy`
Specifies the type of medium. Valid values are `disk` (hard drive), `dvd`, or `floppy`.

uuid | filename
Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.

property-name
Specifies the name of the property.

Examples

The following command sets the property called `prop1` to `val1` for the `ol7.vdi` disk image.

```
$ VBoxManage mediumproperty disk set ol7.vdi prop1 val1
```

The following command gets the value of the property called `prop1` for the `ol7.vdi` disk image.

```
$ VBoxManage mediumproperty disk get ol7.vdi prop1
```

VBoxManage metrics

Monitor system resource usage

Synopsis

```
VBoxManage metrics collect [--detach] [--list] [--period=seconds]
[--samples=count] [* | host | vmname metric-list]
```

```
VBoxManage metrics disable [--list] [* | host | vmname metric-list]
```

```
VBoxManage metrics enable [--list] [* | host | vmname metric-list]
```

```
VBoxManage metrics list [* | host | vmname metric-list]
```

```
VBoxManage metrics query [* | host | vmname metric-list]
```

```
VBoxManage metrics setup [--list] [--periodseconds] [--samplescount] [* |
host | vmname metric-list]
```

Description

The `VBoxManage metrics` command enables you to monitor system resource usage for the host system and for virtual machines (VMs). For example, you can monitor particular metrics, such as the percentage of time CPUs spend executing in user mode (`CPU/Load/User`) over a specified sampling period.

While it runs, the `VBoxSVC` process collects and saves the specified metric data internally. The `VBoxSVC` process runs until shortly after you close all VMs and frontends. Use the `VBoxManage metrics query` command to retrieve data at any time.

By default, metrics are not collected unless you run the `VBoxManage metrics setup` command to specify a sampling interval in seconds and the number of metrics to save.

Note that you can enable metric collection only for started VMs. Collected data and collection settings for a VM are discarded when the VM shuts down.

Metrics

The host and VMs have different sets of associated metrics, which you can view by running the `VBoxManage metrics list` command.

Each metric is represented as a string that is composed of a category and a metric. Optionally, the metric string can include any of the following: a submetric, a sub-submetric, and an aggregate. The metric string has the following format:

category`/`*metric*`[/`*submetric*`[/`*sub-submetric*`]][:`*aggregate*`]`

- *category* is the resource type, such as `CPU`, `RAM`, `FS`, `Net`.
- *metric* is a measurement type that is associated with the resource category. For example, the `Load` and `MHz` metrics are associated with the `CPU` resource category.
- *submetric* is an optional measurement type that is associated with the metric. For example, the `User`, `Kernel`, and `Idle` submetrics are associated with the `Load` metric.
- *sub-submetric* is an optional measurement type that is associated with the submetric. For example, the `Rx` and `Tx` sub-submetrics are associated with the `Rate` submetric of the `Net` resource category. The associated metric is the network interface.
- *aggregate* is an optional function to provide minimum, maximum, and average measurements for a resource category. For example, the `RAM/Usage/Free:min` metric represents the minimum amount of available memory found in all saved data on the host system.

By default, the `VBoxManage metrics` commands operate on the host system and all VMs, and report on all metrics. You can optionally limit these commands to operate on the host system or on a particular VM, and report on a list of one or more metrics.

Common Options

`*` | `host` | *vmname*
Specifies the component on which to operate. By default, this command operates on the host system and all running VMs.
If you specify `host`, the `VBoxManage metrics` command operates on the host system only. If you specify an asterisk (`*`), the command operates on all VMs. If you specify the name of a VM, the `VBoxManage metrics` command operates on that VM.

metric-list
Specifies a comma-separated list of one or more metrics.
The form of the metric must include the *category* and *metric* part of the metric string separated by a slash.
Note that the `VBoxManage metrics enable` and `VBoxManage metrics disable` commands require that you specify metrics as parameters. The metrics must include only the resource category and metric part, such as `CPU/Load` and `RAM/Usage`.

Collect Data Metrics

```
VBoxManage metrics collect [--detach] [--list] [--period=seconds]
[--samples=count] [* | host | vmname metric-list]
```

The `VBoxManage metrics collect` command collects and outputs data periodically until you stop the process by pressing Ctrl+C.

`--detach`
Disables the collection of metric data, so no data is output. Using this option is the same as running the `VBoxManage metrics setup` command.

`--list`
Shows which metrics match the specified filter.

`--period=` *seconds*
Specifies the number of seconds to wait between collecting metric data samples. The default value is 1.

`--samples=` *count*
Specifies the number of metric data samples to save. To view the saved data, use the `VBoxManage metrics query` command. The default value is 1.

Disable Metric Data Collection

```
VBoxManage metrics disable [--list] [* | host | vmname metric-list]
```

The `VBoxManage metrics disable` command suspends data collection. This action does not affect the data collection properties or the collected data. Note that specifying a submetric in the metric list does not disable its underlying metrics.

Note that the `VBoxManage metrics disable` command requires that you specify metrics as parameters. The metrics must include only the resource category and metric part, such as `CPU/Load` and `RAM/Usage`.

`--list`
Shows whether the command succeeded as expected.

Enable Metric Data Collection

```
VBoxManage metrics enable [--list] [* | host | vmname  metric-list]
```

The `VBoxManage metrics enable` command resumes data collection after it has been suspended by using the `VBoxManage metrics disable` command. Note that specifying a submetric in the metric list does not enable its underlying metrics.

Unlike the `VBoxManage metrics setup` command, the `VBoxManage metrics enable` command does not discard previously collected samples for the specified set of objects and metrics.

Note that the `VBoxManage metrics enable` command requires that you specify metrics as parameters. The metrics must include only the resource category and metric part, such as `CPU/Load` and `RAM/Usage`.

`--list`
Shows whether the command succeeded as expected.

List Metric Values

```
VBoxManage metrics list [* | host | vmname  metric-list]
```

The `VBoxManage metrics list` command shows the metrics that are currently available. Note that VM-specific metrics are shown only when that VM is running.

List Saved Metric Data

```
VBoxManage metrics query [* | host | vmname  metric-list]
```

The `VBoxManage metrics query` command retrieves and shows the saved metric data.

Note that the `VBoxManage metrics query` command does not remove or flush saved data but older samples are replaced by newer samples over time.

Configure Metric-Gathering Properties

```
VBoxManage metrics setup [--list] [--periodseconds] [--samplescount] [* |
host | vmname  metric-list]
```

The `VBoxManage metrics setup` command configures metric-gathering properties.

Note that this command discards any previously collected samples for the specified set of objects and metrics. To enable or disable metrics collection without discarding the data, use the `VBoxManage metrics enable` command or the `VBoxManage metrics disable` command, respectively.

`--list`
Shows which metrics have been modified as a result of the command execution.

`--period=`*seconds*
Specifies the number of seconds to wait between collecting metric data samples. The default value is 1.

`--samples=`*count*
Specifies the number of metric data samples to save. To view the saved data, use the `VBoxManage metrics query` command. The default value is 1.

Examples

The following example command enables the collection of host processor and memory usage metrics every second. The `--samples` option saves the five latest samples.

```
$ VBoxManage metrics setup --period 1 --samples 5 host CPU/Load,RAM/Usage
```

The following command lists the metrics that are available to the host system and VMs:

```
$ VBoxManage metrics list
```

Note that the host system and VMs have different sets of metrics.

The following example shows how to query metric data about the CPU time spent in user and kernel modes for the `test` VM:

```
$ VBoxManage metrics query test CPU/Load/User,CPU/Load/Kernel
```

VBoxManage modifymedium

Change the characteristics of an existing disk image

Synopsis

```
VBoxManage modifymedium [disk | dvd | floppy] <uuid | filename>
[--autoreset=on | off] [--compact] [--description=description]
[--move=pathname] [--property=name=[value]] [--resize=megabytes |
--resizebyte=bytes] [--setlocation=pathname] [--type=normal | writethrough
| immutable | shareable | readonly | multiattach]
```

Description

The `VBoxManage modifymedium` command enables you to change the characteristics of an existing disk image.

> **Note:**
>
> For compatibility with earlier versions of Oracle VM VirtualBox, you can use the `modifyvdi` and `modifyhd` commands.

disk | dvd | floppy
Specifies the media type of the image.

filename
Specifies the Universally Unique Identifier (UUID) or path name of the disk image on the host file system. You can specify the UUID only if the medium is registered. Use the `VBoxManage list hdds` command to list the registered images. You can specfy an absolute or relative path to the medium.

`--autoreset=on | off`
Specifies whether to automatically reset an immutable hard disk on every virtual machine (VM) startup. This option is only for immutable hard disks and the default value is `on`. See Special Image Write Modes.

`--compact`
Compresses disk images by removing blocks that contain only zeroes. This option shrinks a dynamically allocated image and reduces the *physical* size of the image without affecting the logical size of the virtual disk.
You can use this option for base images and for differencing images that are created as part of a snapshot.

> **Note:**
>
> Before you compress the image, you must use a suitable software tool to zero out free space in the guest system. For example:
>
> - *Windows guests.* Run the `sdelete -z` command.
> - *Linux guests.* Use the `zerofree` utility, which supports `ext2` and `ext3` file systems.
> - *Mac OS X guests.* Use the `diskutil secureErase freespace 0 /` command.

Note that you can only use this option to compress VDI images. To compress non-VID images, you can zero out free blocks and then clone the disk to any other dynamically allocated format.

`--description=` *description*
Specifies a text description of the medium.

`--move=` *pathname*
Specifies a relative or absolute path to a medium on the host system. Use this option to relocate a medium to a different location on the host system.

`--property=` *name* = *value*
Specifies a property name and value for the medium.

`--resize=` *size*
Specifes the new capacity of an existing image in MB. You can use this option only to expand the capacity of an image. You can cannot shrink the capacity of an image.
Note that you can resize only dynamically allocated disk images that use the VDI and VHD formats. This option adjusts the *logical* size of a virtual disk and has only a minor affect on the physical size.
For example, if your dynamically allocated 10 GB disk is full, you can use the `--resize 15360` option to increase the capacity of the existing disk to 15 GB (15,360 MB). This operation enables you to avoid having to create a new image and copy all data from within a VM.
Note that using this option only changes the capacity of the drive. So, you might need to subsequently use a partition management tool in the guest to adjust the main partition to fill the drive.

`--resizebyte=` *size*
Specifes the new capacity of an existing image in bytes. This option is similar to the `--resize` option, but you specify the size in bytes instead of megabytes.

`--setlocation=` *pathname*
Specifies the new location of the medium on the host system after the medium has been moved. The path name can be relative to the current directory or be absolute to the root.
Note that the `VBoxManage modifymedium` command does not perform any sanity checks on the path name you specify. Ensure that the path name is valid.

`--type`
Specifies the new mode type of an existing image. Valid values are `normal`, `immutable`, `writethrough`, `multi-attach`, `shareable`, and `readonly`. For descriptions of these mode types, see Special Image Write Modes.

Examples

The following command modifies the description for the disk image file called `disk01.vdi`.

```
$ VBoxManage modifymedium disk disk01.vdi --description "Oracle Linux 7 image"
```

The following command modifies the write mode for the disk image file called `disk01.vdi`.

```
$ VBoxManage modifymedium disk disk01.vdi --type writethrough
```

See Also

VBoxManage list

VBoxManage modifynvram

List and modify the NVRAM content of a virtual machine

Synopsis

```
VBoxManage modifynvram <uuid | vmname> inituefivarstore
```

```
VBoxManage modifynvram <uuid | vmname> enrollmssignatures
```

```
VBoxManage modifynvram <uuid | vmname> enrollorclpk
```

```
VBoxManage modifynvram <uuid | vmname> enrollpk [--platform-key=filename]
[--owner-uuid=uuid]
```

```
VBoxManage modifynvram <uuid | vmname> enrollmok [--mok=filename]
[--owner-uuid=uuid]
```

```
VBoxManage modifynvram <uuid | vmname> listvars
```

```
VBoxManage modifynvram <uuid | vmname> queryvar [--name=name]
[--filename=filename]
```

```
VBoxManage modifynvram <uuid | vmname> deletevar [--name=name]
[--owner-uuid=uuid]
```

```
VBoxManage modifynvram <uuid | vmname> changevar [--name=name]
[--filename=filename]
```

Description

The "modifynvram" commands are for experts who want to inspect and modify the UEFI variable store of a virtual machine. Any mistakes done here can bring the virtual machine in a non working state.

Common options

The subcommands of `modifynvram` all operate on a running virtual machine:

uuid* | *vmname
Either the UUID or the name (case sensitive) of a VM.

modifynvram inituefivarstore

```
VBoxManage modifynvram <uuid | vmname> inituefivarstore
```

Iniitalizes the UEFI variable store to a default state. Any previous existing variable store is deleted. Use with extreme caution!

modifynvram enrollmssignatures

```
VBoxManage modifynvram <uuid | vmname> enrollmssignatures
```

Enrolls the default Microsoft KEK and DB signatures required for UEFI secure boot.

modifynvram enrollorclpk

```
VBoxManage modifynvram <uuid | vmname> enrollorclpk
```

Enrolls the default platform key provided by Oracle required for UEFI secure boot.

modifynvram enrollpk

```
VBoxManage modifynvram <uuid | vmname> enrollpk [--platform-key=filename]
[--owner-uuid=uuid]
```

Enrolls a custom platform key provided by the user required for UEFI secure boot. The following commands use openssl to generate a new platform key:

```
$ openssl req -new -x509 -newkey rsa:2048 -keyout PK.key -out PK.crt

$ openssl x509 -in PK.crt -out PK.cer -outform DER
```

`--platform-key=` *filename*
The platform key provided as a DER encoded X.509 signature.

`--owner-uuid=` *uuid*
The UUID identifying the owner of the platform key.

modifynvram listvars

```
VBoxManage modifynvram <uuid | vmname> listvars
```

Lists all UEFI variables in the virtual machines's store along with their owner UUID.

modifynvram queryvar

```
VBoxManage modifynvram <uuid | vmname> queryvar [--name=name]
[--filename=filename]
```

Queries the content of a given UEFI variable identified by its name.

`--name=` *name*
UEFI variable name to query.

`--filename=` *filename*
Where to store the content of the variable upon success. This is optional, if omitted the content will be dumped to the terminal as a hex dump.

modifynvram deletevar

```
VBoxManage modifynvram <uuid | vmname> deletevar [--name=name]
[--owner-uuid=uuid]
```

Deletes the given variable identified by its name and owner UUID.

`--name=` *name*
UEFI variable name to delete.

`--owner-uuid=` *uuid*
The UUID identifying the owner of the variable to delete.

modifynvram changevar

```
VBoxManage modifynvram <uuid | vmname> changevar [--name=name]
[--filename=filename]
```

Changes the UEFI variable content to the one form the given file.

`--name=` *name*
UEFI variable name to change the data for.

`--filename=` *filename*
The file to read the data from.

VBoxManage modifyvm

Change settings for a virtual machine that is stopped

Synopsis

```
VBoxManage modifyvm <uuid | vmname> [--name=name] [--groups=group
[,group...]] [--description=description] [--os-type=OS-type]
[--icon-file=filename] [--memory=size-in-MB] [--page-fusion=on | off]
[--vram=size-in-MB] [--acpi=on | off] [--ioapic=on | off]
[--hardware-uuid=UUID] [--cpus=CPU-count] [--cpu-hotplug=on | off]
[--plug-cpu=CPU-ID] [--unplug-cpu=CPU-ID] [--cpu-execution-cap=number]
[--pae=on | off] [--long-mode=on | off] [--ibpb-on-vm-exit=on | off]
[--ibpb-on-vm-entry=on | off] [--spec-ctrl=on | off]
[--l1d-flush-on-sched=on | off] [--l1d-flush-on-vm-entry=on | off]
[--mds-clear-on-sched=on | off] [--mds-clear-on-vm-entry=on | off]
[--cpu-profile=host | Intel 8086 | Intel 80286 | Intel 80386] [--hpet=on
| off] [--hwvirtex=on | off] [--triple-fault-reset=on | off] [--apic=on |
off] [--x2apic=on | off] [--paravirt-provider=none | default | legacy |
minimal | hyperv | kvm] [--paravirt-debug=key=value[,key=value...]]
[--nested-paging=on | off] [--large-pages=on | off] [--vtx-vpid=on | off]
[--vtx-ux=on | off] [--nested-hw-virt=on | off] [--virt-vmsave-vmload=on |
off] [--accelerate-3d=on | off] [--accelerate-2d-video=on | off]
[--chipset=ich9 | piix3] [--iommu=none | automatic | amd | intel]
[--tpm-type=none | 1.2 | 2.0 | host | swtpm] [--tpm-location=location]
[--bios-logo-fade-in=on | off] [--bios-logo-fade-out=on | off]
[--bios-logo-display-time=msec] [--bios-logo-image-path=pathname]
[--bios-boot-menu=disabled | menuonly | messageandmenu]
[--bios-apic=disabled | apic | x2apic] [--bios-system-time-offset=msec]
[--bios-pxe-debug=on | off] [--system-uuid-le=on | off] [--bootX= none |
floppy | dvd | disk | net] [--rtc-use-utc=on | off]
[--graphicscontroller=none | vboxvga | vmsvga | vboxsvga]
[--snapshot-folder=default | pathname] [--firmware=bios | efi | efi32 |
efi64] [--guest-memory-balloon=size-in-MB] [--default-frontend=default |
name] [--vm-process-priority=default | flat | low | normal | high]
```

```
VBoxManage modifyvm <uuid | vmname> [--nicN= none | null | nat |
bridged | intnet | hostonly | hostonlynet | generic | natnetwork |
cloud] [--nic-typeN= Am79C970A | Am79C973 | 82540EM | 82543GC | 82545EM
| virtio] [--cable-connectedN= on | off] [--nic-traceN= on | off]
[--nic-trace-fileN=filename] [--nic-propertyN=name= [value]]
[--nic-speedN=kbps] [--nic-boot-prioN=priority] [--nic-promiscN= deny |
allow-vms | allow-all] [--nic-bandwidth-groupN= none | name]
[--bridge-adapterN= none | device-name] [--cloud-networkN=network-name]
```

[--host-only-adapter*N*= none | *device-name*] [--host-only-net*N*=*network-name*]
[--intnet*N*=*network-name*] [--nat-network*N*=*network-name*]
[--nic-generic-drv*N*=*driver-name*] [--mac-address*N*= auto | *MAC-address*]

VBoxManage modifyvm <*uuid* | *vmname*> [--nat-net*N*= *network* | default]
[--nat-pf*N*= [*rule-name*],tcp | udp,[*host-IP*],*hostport*,[*guest-IP*],*guestport*]
[--nat-pf*N*=delete=*rule-name*] [--nat-tftp-prefix*N*=*prefix*]
[--nat-tftp-file*N*=*filename*] [--nat-tftp-server*N*=*IP-address*]
[--nat-bind-ip*N*=*IP-address*] [--nat-dns-pass-domain*N*= on | off]
[--nat-dns-proxy*N*= on | off] [--nat-dns-host-resolver*N*= on | off]
[--nat-localhostreachable*N*= on | off] [--nat-settings*N*=[*mtu*],[*socksnd*],
[*sockrcv*],[*tcpsnd*],[*tcprcv*]] [--nat-alias-mode*N*= default | [log],
[proxyonly],[sameports]]

VBoxManage modifyvm <*uuid* | *vmname*> [--mouse=ps2 | usb | usbtablet |
usbmultitouch | usbmtscreenpluspad] [--keyboard=ps2 | usb] [--uart*N*=
off | *IO-base IRQ*] [--uart-mode*N*= disconnected | server*pipe* | client*pipe*
| tcpserver*port* | tcpclient*hostname*:*port* | file*filename* | *device-name*]
[--uart-type*N*= 16450 | 16550A | 16750] [--lpt-mode*N*=*device-name*] [--lpt*N*=
off | *IO-base IRQ*] [--audio-controller=ac97 | hda | sb16]
[--audio-codec=stac9700 | ad1980 | stac9221 | sb16] [--audio-driver=none
| default | null | dsound | was | oss | alsa | pulse | coreaudio]
[--audio-enabled=on | off] [--audio-in=on | off] [--audio-out=on | off]
[--clipboard-mode=disabled | hosttoguest | guesttohost | bidirectional]
[--clipboard-file-transfers=enabled | disabled] [--drag-and-drop=disabled
| hosttoguest | guesttohost | bidirectional] [--monitor-count=*number*]
[--usb-ehci=on | off] [--usb-ohci=on | off] [--usb-xhci=on | off]
[--usb-rename=*old-name new-name*]

VBoxManage modifyvm <*uuid* | *vmname*> [--recording=on | off]
[--recording-screens=all | none | *screen-ID*[,*screen-ID*...]]
[--recording-file=*filename*] [--recording-max-size=*MB*]
[--recording-max-time=*msec*] [--recording-opts= *key*=*value*[,*key*=*value*...]]
[--recording-video-fps=*fps*] [--recording-video-rate=*rate*]
[--recording-video-res=*width*x*height*]

VBoxManage modifyvm <*uuid* | *vmname*> [--vrde=on | off]
[--vrde-property=*property-name*= [*property-value*]] [--vrde-extpack=default |
name] [--vrde-port=*port*] [--vrde-address=*hostip*] [--vrde-auth-type=null |
external | guest] [--vrde-auth-library=default | *name*]
[--vrde-multi-con=on | off] [--vrde-reuse-con=on | off]
[--vrde-video-channel=on | off] [--vrde-video-channel-quality=*percent*]

```
VBoxManage modifyvm <uuid | vmname> [--teleporter=on | off]
[--teleporter-port=port] [--teleporter-address=address | empty]
[--teleporter-password=password] [--teleporter-password-file=filename |
stdin] [--cpuid-portability-level=level] [--cpuid-set=leaf [:subleaf]
eax ebx ecx edx] [--cpuid-remove=leaf [:subleaf]] [--cpuid-remove-all]
```

```
VBoxManage modifyvm <uuid | vmname> [--tracing-enabled=on | off]
[--tracing-config=string] [--tracing-allow-vm-access=on | off]
```

```
VBoxManage modifyvm <uuid | vmname> [--usb-card-reader=on | off]
```

```
VBoxManage modifyvm <uuid | vmname> [--autostart-enabled=on | off]
[--autostart-delay=seconds]
```

```
VBoxManage modifyvm <uuid | vmname> [--guest-debug-provider=none |
native | gdb | kd] [--guest-debug-io-provider=none | tcp | udp | ipc]
[--guest-debug-address=IP-Address | path] [--guest-debug-port=port]
```

```
VBoxManage modifyvm <uuid | vmname> [--pci-attach=host-PCI-address
[@guest-PCI-bus-address]] [--pci-detach=host-PCI-address]
```

```
VBoxManage modifyvm <uuid | vmname> [--testing-enabled=on | off]
[--testing-mmio=on | off] [--testing-cfg-dwordidx=value]
```

Description

The `VBoxManage modifyvm` command enables you to change the properties of a registered virtual machine (VM) that is not running.

Most of these properties correspond to the VM settings that are shown in each VM's *Settings* dialog in the VirtualBox Manager. See Configuring Virtual Machines. However, some settings can only be viewed and managed with the `VBoxManage` command.

You can use the `VBoxManage modifyvm` command to change VM settings only when the VM is powered off. The VM cannot be running or in saved state when you use this command.

You can use the `VBoxManage controlvm` command to dynamically change some VM machine settings while the VM is running. See VBoxManage controlvm.

General Settings

```
VBoxManage modifyvm <uuid | vmname> [--name=name] [--groups=group
[,group...]] [--description=description] [--os-type=OS-type]
[--icon-file=filename] [--memory=size-in-MB] [--page-fusion=on | off]
[--vram=size-in-MB] [--acpi=on | off] [--ioapic=on | off]
[--hardware-uuid=UUID] [--cpus=CPU-count] [--cpu-hotplug=on | off]
[--plug-cpu=CPU-ID] [--unplug-cpu=CPU-ID] [--cpu-execution-cap=number]
[--pae=on | off] [--long-mode=on | off] [--ibpb-on-vm-exit=on | off]
[--ibpb-on-vm-entry=on | off] [--spec-ctrl=on | off]
[--l1d-flush-on-sched=on | off] [--l1d-flush-on-vm-entry=on | off]
[--mds-clear-on-sched=on | off] [--mds-clear-on-vm-entry=on | off]
[--cpu-profile=host | Intel 8086 | Intel 80286 | Intel 80386] [--hpet=on
| off] [--hwvirtex=on | off] [--triple-fault-reset=on | off] [--apic=on |
off] [--x2apic=on | off] [--paravirt-provider=none | default | legacy |
minimal | hyperv | kvm] [--paravirt-debug=key=value[,key=value...]]
[--nested-paging=on | off] [--large-pages=on | off] [--vtx-vpid=on | off]
[--vtx-ux=on | off] [--nested-hw-virt=on | off] [--virt-vmsave-vmload=on |
off] [--accelerate-3d=on | off] [--accelerate-2d-video=on | off]
[--chipset=ich9 | piix3] [--iommu=none | automatic | amd | intel]
[--tpm-type=none | 1.2 | 2.0 | host | swtpm] [--tpm-location=location]
[--bios-logo-fade-in=on | off] [--bios-logo-fade-out=on | off]
[--bios-logo-display-time=msec] [--bios-logo-image-path=pathname]
[--bios-boot-menu=disabled | menuonly | messageandmenu]
[--bios-apic=disabled | apic | x2apic] [--bios-system-time-offset=msec]
[--bios-pxe-debug=on | off] [--system-uuid-le=on | off] [--bootX= none |
floppy | dvd | disk | net] [--rtc-use-utc=on | off]
[--graphicscontroller=none | vboxvga | vmsvga | vboxsvga]
[--snapshot-folder=default | pathname] [--firmware=bios | efi | efi32 |
efi64] [--guest-memory-balloon=size-in-MB] [--default-frontend=default |
name] [--vm-process-priority=default | flat | low | normal | high]
```

The following options enable you to modify general information about your VM.

The `VBoxManage modifyvm` command supports the following options:

`--name=` *vmname*
Changes the name of the VM and its related internal VM files. See VBoxManage createvm.

`--groups=` *group*
Changes the group membership of a VM. Group names always begin with a slash character (`/`) and can be nested. By default, VMs are members of the `/` group. A VM can be member of multiple groups, but its primary group determines the directory structure where the internal VM files are placed by default.

`--description=` *`desc`*
Changes the optional VM description. Use a description to record details about the VM in a meaningful way. The GUI interprets HTML markup while the `VBoxManage modifyvm` command enables you include arbitrary strings that can contain multiple lines.

`--os-type=` *`OS-type`*
Specifies the guest operating system (OS) information for the VM. Use the `VBoxManage list ostypes` command to view the OS type identifiers.

`--icon-file=` *`filename`*
Specifies the path to the VM icon file in PNG format on the host system. The icon is shown in the VM manager UI and when running the VM with UI.

`--memory=` *`size`*
Specifies the amount of host system RAM to allocate to the VM. The size is in MB. See Creating Your First Virtual Machine.

`--page-fusion=on | off`
Enables or disables the Page Fusion feature, which is disabled by default. Use the Page Fusion feature to minimize the memory duplication between VMs that have similar configurations and that run on the same host system. See Page Fusion.

`--vram=` *`size`*
Specifies the amount of RAM to allocate to the virtual graphics card. See Display Settings.

`--acpi=on | off`
Determines whether the VM has ACPI support. See Motherboard Tab.

`--ioapic=on | off`
Determines whether the VM has I/O APIC support. See Motherboard Tab.

`--hardware-uuid=` *`uuid`*
Specifies the Universally Unique Identifier (UUID) to present to the guest VM in memory tables (DMI/SMBIOS), hardware, and VM properties. By default this hardware UUID is the same as the VM UUID. Cloning a VM and the teleporting feature automatically preserve the hardware UUID value. Likewise for Virtual Appliance export and import, but only if both operations are done by Oracle VM VirtualBox.

`--cpus=` *`CPU-count`*
Specifies the number of virtual CPUs to assign to the VM. See Processor Tab.
If CPU hot-plugging is enabled, this option specifies the maximum number of virtual CPUs that can be plugged into the VMs.

`--cpu-hotplug=on | off`
Enables or disables CPU hot-plugging. When enabled, you can dynamically add virtual CPUs to a VM or remove virtual CPUs from a VM. See CPU Hot-Plugging.

`--plug-cpu=` *`CPU-ID`*
Adds a virtual CPU to the VM. *CPU-ID* is the index of the virtual CPU to add. A valid index value is a number from `0` to the maximum number of CPUs that you configured by using the `--cpus` option.
Only use this option if CPU hot-plugging is enabled.

`--unplug-cpu=` *CPU-ID*
Removes a virtual CPU from the VM. *CPU-ID* is the index of the virtual CPU to remove. A valid index value is a number from `1` to the maximum number of CPUs that you configured by using the `--cpus` option.
Only use this option if CPU hot-plugging is enabled.
Note that you cannot remove CPU 0.

`--cpuexectioncap=` *percentage*
Specifies how much CPU time a virtual CPU can use. A valid value is from `1` to `100`. A value of 50 indicates that a single virtual CPU can use up to 50% of a single host CPU.
Use this feature with caution, it can have unexpected results including timekeeping problems and lower performance than specified. If you want to limit the resource usage of a VM it is more reliable to pick an appropriate number of VCPUs.

`--pae=on | off`
Enables or disables physical address extension (PAE). See Processor Tab.

`--long-mode=on | off`
Enables or disables long mode. See Processor Tab.

`--ibpb-on-vm-exit=on | off`
Enables use of Indirect Branch Prediction Barrier (IBPB) on every VM exit.

`--ibpb-on-vm-entry=on | off`
Enables use of Indirect Branch Prediction Barrier (IBPB) on every VM entry.

`--spec-ctrl=on | off`
Enables or disables the exposure of speculation control interfaces to the guest VM. These interfaces must be available on the host system.
Depending on the host CPU and the workload, enabling speculation control might significantly reduce performance.

`--l1d-flush-on-sched=on | off`
Enables or disables level 1 data cache flushing when a thread is scheduled to execute guest code. See CVE-2018-3646.

`--l1d-flush-on-vm-entry=on | off`
Enables or disables level 1 data cache flushing on every VM entry. See CVE-2018-3646.

`--mds-clear-on-sched=on | off`
Enables CPU buffer clearing when a thread is scheduled to execute guest code. See CVE-2018-12126, CVE-2018-12127, CVE-2018-12130, CVE-2019-11091.

`--mds-clear-on-vm-entry=on | off`
Enables CPU buffer clearing on every VM entry. See CVE-2018-12126, CVE-2018-12127, CVE-2018-12130, CVE-2019-11091.

`--cpu-profile=host | Intel 8086 | Intel 80286 | Intel 80386`
Specifies the profile to use for guest CPU emulation. Specify a value that is based on the host system CPU (`host`) or one of the following older Intel micro-architectures: `8086`, `80286`, or `80386`.

`--hpet=on | off`
Enables or disables a High Precision Event Timer (HPET) that can replace a legacy system timer. This feature is disabled by default. Note HPET is supported on Windows versions starting with Vista.

`--hwvirtex=on | off`
Enables or disables the use of hardware virtualization extensions in the processor of the host system. Such extensions are Intel VT-x or AMD-V. See Hardware Virtualization.

`--triple-fault-reset=on | off`
Enables or disables the resetting of the guest VM instead of triggering a Guru Meditation. Some guest VMs raise a triple fault to reset the CPU, so sometimes resetting the guest VM is the best outcome. This option only applies to guests that do not use symmetric multiprocessing (SMP).

`--apic=on | off`
Enables or disables APIC. With APIC, OSes can use more than 16 interrupt requests (IRQs) to avoid IRQ sharing and to improve reliability. APIC is enabled by default. See Motherboard Tab.

`--x2apic=on | off`
Enables or disables the CPU x2APIC feature. CPU x2APIC enables an OS to run more efficiently on high core count configurations and to optimize interrupt distribution in virtualized environments. This feature is enabled by default.
Disable this feature when the OS that runs on a host system or a guest VM is incompatible with CPU x2APIC.

`--paravirt-provider=none | default | legacy | minimal | hyperv | kvm`
Specifies one of the following paravirtualization interfaces to provide to the guest OS:

- `none` does not expose any paravirtualization interface.
- `default` selects the appropriate interface based on the guest OS type when starting the VM. This is the default value used when creating new VMs.
- `legacy` selects a paravirtual interface for VMs that were created by older Oracle VM VirtualBox versions.
- `minimal` is required for Mac OS X guest VMs.
- `kvm` is recommended for Linux guest VMs. See Paravirtualization Providers.
- `hyperv` is recommended for Windows guest VMs. See Paravirtualization Providers.

`--paravirt-debug=` *property* `=` *value*
Specifies debugging properties that are specific to the paravirtualization provider configured for the specified VM. See Paravirtualized Debugging.

`--nested-paging=on | off`
Enables or disables the nested paging feature in the processor of the host system. This option is available only when hardware virtualization is enabled. See Hardware Virtualization and CVE-2018-3646.

`--large-pages=on | off`
Enables or disables the hypervisor's use of large pages, which can improve performance by up to 5%. The use of large pages reduces TLB use and overhead. This option is available only when both hardware virtualization and nested paging are enabled.

`--vtx-vpid=on | off`
Enables or disables the use of the tagged TLB (VPID) feature in the processor of your host system. See Hardware Virtualization. This option is available only when hardware virtualization is enabled on Intel VT-x.

--vtx-ux=on | off
Enables or disables the use of unrestricted guest mode for executing the guest VM. This option is available only when hardware virtualization is enabled on Intel VT-x.

--nested-hw-virt=on | off
Enables or disables nested virtualization. Enabling makes hardware virtualization features available to the VM. See Nested Virtualization.

--virt-vmsave-vmload=on | off
If hardware virtualization is enabled and the host has an AMD CPU, this setting enables or disables the use of the virtualized vmsave/vmload host feature while executing the VM. It is enabled by default. It is recommended to leave it enabled as it has a drastic impact on performance while executing nested VMs when using the nested hardware virtualization feature. Nested Virtualization.

--accelerate-3d=on | off
Enables or disables hardware 3D acceleration for the graphics adapter variants which support it. This option has an effect only when the Guest Additions are installed. See Hardware 3D Acceleration (OpenGL and Direct3D 8/9).

--accelerate-2d-video=on | off
Enables or disables 2D video acceleration for the graphics adapter variants which support it. This option has an effect only when the Guest Additions are installed. See Hardware 2D Video Acceleration for Windows Guests.

--chipset=piix3 | ich9
Specify the Intel chipset for Oracle VM VirtualBox to emulate. The default value is the Intel PIIX3 chipset (`piix3`).
Change this value only if you need to relax some of the chipset constraints. See Motherboard Tab.

--iommu=none | automatic | amd | intel
Specifies the IOMMU type for Oracle VM VirtualBox to emulate. Both Intel and AMD IOMMU emulation currently require the use of the Intel ICH9 chipset (see `--chipset` option).
Valid values are as follows:

- `none` – No IOMMU is present and is the default value.
- `automatic` – An IOMMU is present but its type is automatically chosen to match the host CPU vendor when the VM is powered on.
- `amd` – An AMD IOMMU is present.
- `intel` – An Intel IOMMU is present.

--tpm-type=none | 1.2 | 2.0 | host | swtpm
Specifies the TPM type for Oracle VM VirtualBox to emulate.
Valid values are as follows:

- `none` – No TPM is present and is the default value.
- `1.2` – A TPM conforming to the TCG specification version 1.2 is present.
- `2.0` – A TPM conforming to the TCG specification version 2.0 is present.
- `host` – The host TPM is passed through to the guest. May not be available on all supported host platforms.

- `swtpm` – The VM connects to an external TPM emulation compliant to swtpm. Requires to set the TPM location to connect to (see `--tpm-location` option).

`--bios-logo-fade-in=on | off`
Specifies whether the BIOS logo fades in on VM startup. By default, an Oracle VM VirtualBox logo is shown.

`--bios-logo-fade-out=on | off`
Specifies whether the BIOS logo fades out on VM startup.

`--bios-logo-display-time=`*msec*
Specifies the amount of time in milliseconds that the BIOS logo is visible.

`--bios-logo-image-path=`*pathname*
Replaces the existing BIOS logo with a different image. The replacement image must be an uncompressed 16, 256 or 16M color bitmap file (BMP) that does not contain color space information (Windows 3.0 format). Also ensure that the image is no larger than 640 X 480 pixels.

`--bios-boot-menu=disabled | menuonly | messageandmenu`
Specifies whether the BIOS permits you to select a temporary boot device. Valid values are:

- `disabled` outputs the alternate boot device message and permits you to select a temporary boot device by pressing F12.
- `menuonly` suppresses the alternate boot device message, but permits you to select a temporary boot device by pressing F12.
- `messageandmenu` suppresses the alternate boot device message and prevents you from selecting a temporary boot device by pressing F12.

`--bios-apic=x2apic | apic | disabled`
Specifies the APIC level of the firmware. Valid values are: `x2apic`, `apic`, and `disabled`. When the value is `disabled`, neither the `apic` nor the `x2apic` version of the firmware is used.
Note that if you specify the `x2apic` value and x2APIC is unsupported by the virtual CPU, the APIC level downgrades to `apic`, if supported. Otherwise, the APIC level downgrades to `disabled`. Similarly, if you specify the `apic` value and APIC is unsupported by the virtual CPU, the APIC level downgrades to `disabled`.

`--bios-system-time-offset=`*msec*
Specifies the time offset in milliseconds of the guest VM relative to the time on the host system. If the offset value is positive, the guest VM time runs ahead of the time on the host system.

`--bios-pxe-debug=on | off`
Enables or disables additional debugging output when using the Intel PXE boot ROM. The debug output is written to the release log file. See Collecting Debugging Information.

`--system-uuid-le=on | off`
Enables or disables representing the system UUID in little endian form. The default value is `on` for new VMs. For old VMs the setting is `off` to keep the content of the DMI/SMBIOS table unchanged, which can be important for Windows license activation.

`--boot`*N*`=none | floppy | dvd | disk | net`
Enables you to specify the boot device order for the VM by assigning one of the device types to each of the four boot device slots that are represented by *N* in the option name.
A value of 1 for *N* represents the first boot device slot, and so on.

The device types are `floppy` for floppy disks, `dvd` for DVDs or CDs, `disk` for hard disks, and `net` for a network device. A value of `none` indicates that no boot device is associated with the specified slot.

`--rtc-use-utc=on | off`
Specifies whether the real-time clock (RTC) uses coordinated universal time (UTC). See Motherboard Tab.

`--graphicscontroller=none | vboxvga | vmsvga | vboxsvga`
Specifies the graphics controller type to use. See Screen Tab.

`--snapshot-folder=default |` *`pathname`*
Specifies the name of the VM's snapshot storage folder. If you specify `default`, the folder name is `Snapshots/` in the machine folder.

`--firmware=bios | efi | efi32 | efi64`
Specifies the firmware used to boot the VM. Valid values are: `bios`, `efi`, `efi32`, or `efi64`. Use EFI values with care.
By default, BIOS firmware is used.

`--guest-memory-balloon=` *`size`*
Specifies the size of the guest memory balloon. The guest memory balloon is the memory allocated by the Guest Additions from the guest OS and returned to the hypervisor for use by other VMs. Specify *size* in megabytes. The default value is `0` megabytes. See Memory Ballooning.

`--default-frontend=default |` *`name`*
Specifies the default frontend to use when starting the specified VM. If you specify `default`, the VM is shown in a window on the user's desktop. See VBoxManage startvm.

`--vm-process-priority=default | flat | low | normal | high`
Specifies the priority scheme of the VM process to use when starting the specified VM and while the VM runs.
The following valid values are:

- `default` – Default process priority determined by the OS.
- `flat` – Assumes a scheduling policy which puts the process at the default priority and with all threads at the same priority.
- `low` – Assumes a scheduling policy which puts the process mostly below the default priority of the host OS.
- `normal` – Assume a scheduling policy which shares the CPU resources fairly with other processes running with the default priority of the host OS.
- `high` – Assumes a scheduling policy which puts the task above the default priority of the host OS. This policy might easily cause other tasks in the system to starve.

Networking Settings

```
VBoxManage modifyvm <uuid | vmname> [--nicN= none | null | nat |
bridged | intnet | hostonly | hostonlynet | generic | natnetwork |
cloud] [--nic-typeN= Am79C970A | Am79C973 | 82540EM | 82543GC | 82545EM
| virtio] [--cable-connectedN= on | off] [--nic-traceN= on | off]
[--nic-trace-fileN=filename] [--nic-propertyN=name= [value]]
[--nic-speedN=kbps] [--nic-boot-prioN=priority] [--nic-promiscN= deny |
allow-vms | allow-all] [--nic-bandwidth-groupN= none | name]
```

```
[--bridge-adapterN= none | device-name] [--cloud-networkN=network-name]
[--host-only-adapterN= none | device-name] [--host-only-netN=network-name]
[--intnetN=network-name] [--nat-networkN=network-name]
[--nic-generic-drvN=driver-name] [--mac-addressN= auto | MAC-address]
```

The following options enable you to modify networking on your VM. With all these options, *N* is an integer greater than zero that represents the particular virtual network adapter to configure.

`--nic`*N*`=none | null | nat | natnetwork | bridged | intnet | hostonly | generic`
Configures the network type used by each virtual network card in the VM.
The following valid values correspond to the modes described in Introduction to Networking Modes:

- `none` – No networking present
- `null` – Not connected to the host system
- `nat` – Use network address translation (NAT)
- `natnetwork` – Use a NAT network
- `bridged` – Use bridged networking
- `intnet` – Use internal networking
- `hostonly` – Use host-only networking
- `generic` – Access rarely used sub-modes

`--nic-type`*N*`=Am79C970A | Am79C973 | 82540EM | 82543GC | 82545EM | virtio`
Identifies the type of networking hardware that Oracle VM VirtualBox presents to the guest VM for the specified virtual network card. See Virtual Networking Hardware.
Valid values are as follows:

- `Am79C970A` represents the AMD PCNet PCI II.
- `Am79C973` represents the AMD PCNet FAST III, which is the default value.
- `82540EM` represents the Intel PRO/1000 MT Desktop.
- `82543GC` represents the Intel PRO/1000 T Server.
- `82545EM` represents the Intel PRO/1000 MT Server.
- `virtio` represents a paravirtualized network adapter.

`--cable-connected`*N*`=on | off`
Temporarily disconnects a virtual network interface, as if you pull a network cable from a physical network card. You might use this option to reset certain software components in the VM.

`--nic-trace`*N*`=on | off`
Enables or disables network tracing for the specified virtual network card.

`--nic-trace-file`*N*` = `*filename*
Specifies the absolute path of the file in which to write trace log information. Use this option if network tracing is enabled.

`--nic-property` *N* = *name* = *value*
Enables you to set property values and pass them to rarely used network backends. To use this option, you must also use the `--nic-generic-drv` option.
These properties are specific to the backend engine and differ between the UDP Tunnel and the VDE backend drivers. For property examples, see UDP Tunnel Networking.

`--nic-speed` *N* = *kbps*
Specifies the throughput rate in kilobits per second for rarely used networking sub-modes such as VDE network and UDP Tunnel. Use this option only if you used the `--nic` option to enable generic networking for the specified virtual network card.

`--nic-boot-prio` *N* = *priority*
Assigns a priority to each NIC that determines the order in which that NIC is used to perform a PXE network boot. The priority value is an integer in the range from `0` to `4`. Priority `0`, which is the default value, is the lowest priority. Priority `1` is the highest priority, and priorities `3` and `4` are lower.
This option has an effect only when using the Intel PXE boot ROM.

`--nic-promisc` *N* =`deny` | `allow-vms` | `allow-all`
Enables you to specify whether to deny or allow promiscuous mode for the specified VM virtual network card. This option is relevant only for bridged networking. Valid values are as follows:

- `deny` hides any traffic that is not intended for the VM. This is the default value.
- `allow-vms` hides all host traffic from the VM, but allows the VM to see traffic to and from other VMs.
- `allow-all` allows the VM to see all traffic.

`--nic-bandwidth-group` *N* =`none` | *name*
Adds or removes a bandwidth group assignment to the specified virtual network interface. Valid values are as follows:

- `none` removes any current bandwidth group assignment from the specified virtual network interface.
- *name* adds a bandwidth group assignment to the specified virtual network interface.

See Limiting Bandwidth for Network Input/Output.

`--bridge-adapter` *N* =`none` | *device-name*
Specifies the host interface to use for the specified virtual network interface. See Bridged Networking. Use this option only if you used the `--nic` option to enable bridged networking for the specified virtual network card.

`--host-only-adapter` *N* =`none` | *device-name*
Specifies which host-only networking interface to use for the specified virtual network interface. See Host-Only Networking. Use this option only if you used the `--nic` option to enable host-only networking for the specified virtual network card.

`--intnet` *N* = *network-name*
Specifies the name of the internal network. See Internal Networking. Use this option only if you used the `--nic` option to enable internal networking for the specified virtual network card.

`--nat-network` *N* = *network-name*
Specifies the name of the NAT network to which this adapter is connected. Use this option only if the networking type is `natnetwork`, not `nat`.

`--nic-generic-drv` *N* = *backend-driver*
Enables you to access rarely used networking sub-modes, such as VDE networks and UDP Tunnel. Use this option only if you used the `--nic` option to enable generic networking for a virtual network card.

`--mac-address` *N* `=auto | ` *MAC-address*
Specifies the MAC address of the specified network adapter on the VM. By default, Oracle VM VirtualBox assigns a random MAC address to each network adapter at VM creation.

NAT Networking Settings

```
VBoxManage modifyvm <uuid | vmname> [--nat-netN= network | default]
[--nat-pfN= [rule-name],tcp | udp,[host-IP],hostport,[guest-IP],guestport]
[--nat-pfN=delete=rule-name] [--nat-tftp-prefixN=prefix]
[--nat-tftp-fileN=filename] [--nat-tftp-serverN=IP-address]
[--nat-bind-ipN=IP-address] [--nat-dns-pass-domainN= on | off]
[--nat-dns-proxyN= on | off] [--nat-dns-host-resolverN= on | off]
[--nat-localhostreachableN= on | off] [--nat-settingsN=[mtu],[socksnd],
[sockrcv],[tcpsnd],[tcprcv]] [--nat-alias-modeN= default | [log],
[proxyonly],[sameports]]
```

The following options use *N* to specify the particular virtual network adapter to modify.

`--nat-net` *N* `=default | ` *network*
Specifies the IP address range to use for this network. See Fine Tuning the Oracle VM VirtualBox NAT Engine. Use this option only if the networking type is `nat`, not `natnetwork`.

`--nat-pf` *N* `=[` *name* `],tcp | udp,[` *host-IP* `],` *hostport* `,[` *guest-IP* `],` *guestport*
Specifies the NAT port-forwarding rule to use. See Configuring Port Forwarding with NAT.

`--nat-pf` *N* `=delete` *name*
Specifies the NAT port-forwarding rule to delete. See Configuring Port Forwarding with NAT.

`--nat-tftp-prefix` *N* = *prefix*
Specifies a prefix to use for the built-in TFTP server. For example, you might use a prefix to indicate where the boot file is located. See PXE Booting with NAT and Configuring the Boot Server (Next Server) of a NAT Network Interface.

`--nat-tftp-file` *N* = *boot-file*
Specifies the name of the TFT boot file. See Configuring the Boot Server (Next Server) of a NAT Network Interface.

`--nat-tftp-server` *N* = *tftp-server*
Specifies the address of the TFTP server from which to boot. See Configuring the Boot Server (Next Server) of a NAT Network Interface.

`--nat-bind-ip` *N* = *IP-address*
Specifies an alternate IP address to which the NAT engine binds. See Tuning TCP/IP Buffers for NAT. By default, Oracle VM VirtualBox's NAT engine routes TCP/IP packets through the default interface assigned by the host's TCP/IP stack.

`--nat-dns-pass-domain`*N*`=on | off`
Specifies whether the built-in DHCP server passes the domain name for network name resolution.

`--nat-dns-proxy`*N*`=on | off`
Specifies whether the NAT engine is the proxy for all guest DNS requests to the host system's DNS servers. See Enabling DNS Proxy in NAT Mode.

`--nat-dns-host-resolver`*N*`=on | off`
Specifies whether the NAT engine uses the host system's resolver mechanisms to handle DNS requests. See Enabling DNS Proxy in NAT Mode.

`--nat-localhostreachable`*N*`=on | off`
Specifies whether the NAT engine allows traffic from the guest directed to 10.0.2.2 to pass to the host's loopback interface, i.e. localhost or 127.0.0.1.

`--nat-settings`*N*`=[`*mtu*`],[`*socksnd*`],[`*sockrcv*`],[`*tcpsnd*`],[`*tcprcv*`]`
Specifies values for tuning NAT performance. See Tuning TCP/IP Buffers for NAT.

`--nat-alias-mode`*N*`=default | [log],[proxyonly],[sameports]`
Specifies the behavior of the NAT engine core as follows:

- `log` enables logging
- `proxyonly` switches off aliasing mode and makes NAT transparent
- `sameports` enforces that the NAT engine sends packets through the same port on which they originated
- `default` disables all aliasing modes

For more information, see Configuring Aliasing of the NAT Engine.

Other Hardware Settings

```
VBoxManage modifyvm <uuid | vmname> [--mouse=ps2 | usb | usbtablet |
usbmultitouch | usbmtscreenpluspad] [--keyboard=ps2 | usb] [--uartN=
off | IO-base IRQ] [--uart-modeN= disconnected | serverpipe | clientpipe
| tcpserverport | tcpclienthostname:port | filefilename | device-name]
[--uart-typeN= 16450 | 16550A | 16750] [--lpt-modeN=device-name] [--lptN=
off | IO-base IRQ] [--audio-controller=ac97 | hda | sb16]
[--audio-codec=stac9700 | ad1980 | stac9221 | sb16] [--audio-driver=none
| default | null | dsound | was | oss | alsa | pulse | coreaudio]
[--audio-enabled=on | off] [--audio-in=on | off] [--audio-out=on | off]
[--clipboard-mode=disabled | hosttoguest | guesttohost | bidirectional]
[--clipboard-file-transfers=enabled | disabled] [--drag-and-drop=disabled
| hosttoguest | guesttohost | bidirectional] [--monitor-count=number]
[--usb-ehci=on | off] [--usb-ohci=on | off] [--usb-xhci=on | off]
[--usb-rename=old-name new-name]
```

The following options enable you to configure other hardware, such as the serial port, monitor, audio device, USB ports, and the clipboard, and drag-and-drop features.

`--mouse=ps2 | usb | usbtablet | usbmultitouch | usbmtscreenpluspad`
Specifies the mode of the mouse to use in the VM. Valid values are: `ps2`, `usb`, `usbtablet`, `usbmultitouch` and `usbmtscreenpluspad`.

`--keyboard=ps2 | usb`
Specifies the mode of the keyboard to use in the VM. Valid values are: `ps2` and `usb`.

`--uart`*N*`=off | `*I/O-base IRQ*
Configures virtual serial ports for the VM. *N* represents the serial port to modify. Valid values are `off` to disable the port or an I/O base address and IRQ. For information about the traditional COM port I/O base address and IRQ values, see Serial Ports.

`--uart-mode`*N* = *mode*
Specifies how Oracle VM VirtualBox connects the specified virtual serial port to the host system that runs the VM. See Serial Ports.
Ensure that you first configure the virtual serial port by using the `--uart`*N* option.
Specify one of the following connection modes for each port:

- `disconnected` indicates that even though the serial port is shown to the guest VM, it is not connected. This state is like a physical COM port without a cable attached.
- `server`*pipe-name* creates the specified named pipe or local domain socket on the host system and connects the virtual serial device to it.

  On a Windows host system, *pipe-name* is a named pipe that has a name that uses the following form: `\\.\pipe\`*pipe-name*.

  On a Linux host system, *pipe-name* is a local domain socket.
- `client`*pipe-name* connects the virtual serial device to the specified named pipe or local domain socket.

  Note that the named pipe or local domain socket must already exist.
- `tcpserver`*port* creates a TCP socket with the specified TCP port on the host system and connects the virtual serial device to it.

  For UNIX-like systems, use ports over 1024 for non-root users.
- `tcpclient`*hostname*:*port* connects the virtual serial device to the TCP socket.

  Note that the TCP socket must already exist.
- `file`*filename* redirects the serial port output to the specified raw file. Ensure that *filename* is the absolute path of the file on the host system.
- *device-name*: specifies the device name of a physical hardware serial port on the specified host system to which the virtual serial port connects.

  Use this mode to connect a physical serial port to a VM.

  On a Windows host system, the device name is a COM port such as `COM1`. On a Linux host system, the device name is similar to `/dev/ttyS0`.

`--uart-type`*N* = *UART-type*
Configures the UART type for the specified virtual serial port (*N*). Valid values are `16450`, `16550A`, and `16750`. The default value is `16550A`.

`--lpt-mode`*N* = *device-name*
Specifies the device name of the parallel port to use.
For a Windows host system, use a device name such as `lpt1`. For a Linux host system, use a device name such as `/dev/lp0`.

`--lpt` *N* = *I/O-base IRQ*
Specifies the I/O base address and IRQ of the parallel port.
You can view the I/O base address and IRQ that the VM uses for the parallel port in the Device Manager.

`--audio-controller=` *controller-type*
Specifies the audio controller to be used with the VM. Valid audio controller type values are: `ac97`, `hda`, and `sb16`.

`--audio-codec=` *codec-type*
Specifies the audio codec to be used with the VM. Valid audio codec type values are: `stac9700`, `ad1980`, `stac9221`, and `sb16`.

`--audio-driver=` *type*
Specifies whether which audio driver (backend) to use. `none`, `default`, `null`, `dsound`, `was`, `oss`, `alsa`, `pulse`, and `coreaudio`.
Note that the audio driver are dependent on the host operating system. Use the `VBoxManage modifyvm` command usage output to determine the supported audio types for your host system.
For maximum interoperability between hosts, the default audio driver can be used. The VM will then automatically select the most appropriate audio driver for the current host available.

`--audio-enabled=on|off`
Specifies whether to enable or disable audio for the VM.
This option has precedence over the --audio-on and --audio-off options, i.e. turning off audio via this option will turn off both, input and output, audio.

`--audio-in=on|off`
Specifies whether to enable or disable audio capture from the host system.

`--audio-out=on|off`
Specifies whether to enable or disable audio playback from the guest VM.

`--clipboard-mode=` *value*
Specifies how to share the guest VM or host system OS's clipboard with the host system or guest VM, respectively. Valid values are: `disabled`, `hosttoguest`, `guesttohost`, and `bidirectional`. See General Settings.
The clipboard feature is available only if you have the Guest Additions be installed in the VM.

`--clipboard-file-transfers=` *value*
Specifies whether file transfers via clipboard between the guest VM and the host are enabled or not. Valid values are: `disabled`, `enabled`. Depends on the current clipboard mode being set.
This clipboard file transfer feature is available only if you have the Guest Additions be installed in the VM.

`--drag-and-drop=` *value*
Specifies how to use the drag and drop feature between the host system and the VM. Valid values are: `disabled`, `hosttoguest`, `guesttohost`, and `bidirectional`. See Drag and Drop.
The drag and drop feature is available only if you have the Guest Additions be installed in the VM.

`--monitor-count=` *count*
Enables you to configure multiple monitors. See Display Settings.

`--usb-ohci=on | off`
Enables or disables the VM's virtual USB 1.1 controller. See USB Settings.

`--usb-ehci=on | off`
Enables or disables the VM's virtual USB 2.0 controller. See USB Settings.

`--usb-xhci=on | off`
Enables or disables the VM's virtual USB 3.0 controller. This is the most efficient option if the VM supports it. See USB Settings.

`--usb-rename=` *old-name new-name*
Rename's the VM's virtual USB controller from *old-name* to *new-name*.

Recording Settings

```
VBoxManage modifyvm <uuid | vmname> [--recording=on | off]
[--recording-screens=all | none | screen-ID[,screen-ID...]]
[--recording-file=filename] [--recording-max-size=MB]
[--recording-max-time=msec] [--recording-opts= key=value[,key=value...]]
[--recording-video-fps=fps] [--recording-video-rate=rate]
[--recording-video-res=widthxheight]
```

The following options enable you to modify settings for video recording, audio recording, or both.

`--recording=on | off`
Enables or disables the recording of a VM session into a WebM or VP8 file. When set to `on`, recording begins when the VM session starts.

`--recording-screens=all | none |` *screen-ID* `[,` *screen-ID* `...`
Enables you to specify the VM screens to record. The recording for each screen is output to its own file. Valid values are: `all`, which records all screens, `none`, which records no screens, or one or more specified screens.

`--recording-file=` *filename*
Specifies the name of the file in which to save the recording.

`--recording-max-size=` *MB*
Specifies the maximum size of the recorded video file in megabytes. When the file reaches the specified size, recording stops. If the value is `0`, recording continues until you manually stop recording.

`--recording-max-time=` *seconds*
Specifies the maximum amount of time to record in seconds. When the specified time elapses, recording stops. If the value is `0`, recording continues until you manually stop recording.

`--recording-opts=` *keyword* = *value*
Specifies additional video-recording properties as a comma-separated property keyword-value list. For example, `foo=bar,a=b`.
Only use this option if you are an advanced user. For information about keywords, see the *Oracle VM VirtualBox Programming Guide and Reference*.

`--recording-video-fps=` *fps*
Specifies the maximum number of video frames per second (FPS) to record. The recording ignores any frames that have a higher frequency. When you increase the FPS, fewer frames are ignored but the recording and the size of the recording file increases.

`--recording-video-rate=` *bit-rate*
Specifies the bit rate of the video in kilobits per second. When you increase the bit rate, the recording appearance improves and the size of the recording file increases.

`--recording-video-res=` *width* `x` *height*
Specifies the video resolution (width and height) of the recorded video in pixels.

Remote Machine Settings

```
VBoxManage modifyvm <uuid | vmname> [--vrde=on | off]
[--vrde-property=property-name= [property-value]] [--vrde-extpack=default |
name] [--vrde-port=port] [--vrde-address=hostip] [--vrde-auth-type=null |
external | guest] [--vrde-auth-library=default | name]
[--vrde-multi-con=on | off] [--vrde-reuse-con=on | off]
[--vrde-video-channel=on | off] [--vrde-video-channel-quality=percent]
```

The following options enable you to modify the VirtualBox Remote Desktop Extension (VRDE) behavior.

`--vrde=on | off`
Enables or disables the VRDE server.

`--vrde-property=TCP/Ports=` *port*
port is the port or port range to which the VRDE server binds. The `default` or `0` value uses port `3389`, which is the standard RDP port.
Also see the `--vrde-port` option description.

`--vrde-property=TCP/Address=` *IP-address*
IP-address is the IP address of the host network interface to which the VRDE server binds. When specified, the server accepts connections only on the host network interface at that IP address.
Also see the `--vrde-address` option description.

`--vrde-property=VideoChannel/Enabled=` *value*
Specifies whether the VRDP video channel is on or off. `1` means `on` and `0` means `off`. See VRDP Video Redirection.

`--vrde-property=Quality=` *value*
Specifies a value between 10% and 100%, inclusive, that represents the JPEG compression level on the VRDE server video channel. A lower value produces lower JPEG quality but higher compression. See VRDP Video Redirection.

`--vrde-property=DownscaleProtection=` *value*
Enables or disables the video downscale protection feature. Valid values are `1` to enable the feature and `0` to disable the feature.
When this feature is enabled, Oracle VM VirtualBox determines whether to display the video:

- When the video size equals the size of the shadow buffer, the video is considered to be full screen and is displayed.
- When the video size is between full screen and the downscale threshold, the video is not displayed. Such a video might be an application window, which is unreadable when downscaled.

When this feature is disabled, an attempt is always made to display a video.

`--vrde-property=Client/DisableDisplay=1`
Disables the display VRDE server feature.
To reenable a feature, assign an empty value. For example, to reenable the display feature, specify the `VBoxManage modifyvm --vrde-property=Client/DisableDisplay=` command. See VRDP Customization.

`--vrde-property=DisableInput=1`
Disables the input VRDE server feature.

`--vrde-property=DisableAudio=1`
Disables the audio VRDE server feature.

`--vrde-property=DisableUSB=1`
Disables the USB VRDE server feature.

`--vrde-property=Client/DisableClipboard=1`
Disables the clipboard VRDE server feature. To reenable the feature, assign an empty value. See VRDP Customization.

`--vrde-property=DisableUpstreamAudio=1`
Disables the upstream audio VRDE server feature. To reenable the feature, assign an empty value. See VRDP Customization.

`--vrde-property=Client/DisableRDPDR=1`
Disables the RDP device redirection for smart cards VRDE server feature. To reenable this feature, assign an empty value.

`--vrde-property=H3DRedirect/Enabled=1`
Enables the 3D redirection VRDE server feature. To disable this feature, assign an empty value.

`--vrde-property=Security/Method=` ***value***
Specifies the following information that is required for a connection:

- `Negotiate` indicates that both Enhanced (TLS) and Standard RDP Security connections are permitted. The security method is negotiated with the client. This is the default value.
- `RDP` indicates that only Standard RDP Security is accepted.
- `TLS` indicates that only Enhanced RDP Security is accepted. The client must support TLS.

See RDP Encryption.

`--vrde-property=ServerCertificate=` ***value***
Specifies the absolute path to the server certificate. See RDP Encryption.

`--vrde-property=ServerPrivateKey=` ***value***
Specifies the absolute path to the server private key. See RDP Encryption.

`--vrde-property=CACertificate=` ***value***
Specifies the absolute path to the CA self-signed certificate. See RDP Encryption.

`--vrde-property Audio/RateCorrectionMode=` ***value***
Specifies the audio connection mode or the path to the audio log file. Valid values are as follows:

- `VRDP_AUDIO_MODE_VOID` is no mode. Use this value to unset any set audio mode.
- `VRDP_AUDIO_MODE_RC` is the rate correction mode.
- `VRDP_AUDIO_MODE_LPF` is the low pass filter mode.
- `VRDP_AUDIO_MODE_CS` is the client sync sync mode to prevent an underflow or overflow of the client queue.

`--vrde-property=LogPath=` *value*
Specifies the absolute path to the audio log file.

`--vrde-extpack=default | ` *name*
Specifies the library to use to access the VM remotely. The `default` value uses the RDP code that is part of the Oracle VM VirtualBox Extension Pack.
To use the VRDE module in VNC, specify `VNC`. See Other Extension Packs.

`--vrde-port=default | ` *port*
port is the port or port range to which the VRDE server binds. The `default` or `0` value uses port `3389`, which is the standard RDP port.
You can specify a comma-separated list of ports or port ranges of ports. Use a dash between two port numbers to specify a port range. The VRDE server binds to only one of the available ports from the list. Only one machine can use a given port at a time. For example, the `--vrde-port=5000,5010-5012` option specifies that server can bind to one of following ports: `5000`, `5010`, `5011`, or `5012`.

`--vrde-address=` *IP-address*
Specifies the IP address of the host network interface to which the VRDE server binds. If you specify an IP address, the server accepts connections only on the specified host network interface.
Use this option to specify whether the VRDP server should accept IPv4, IPv6, or both type of connections:

- *Only IPv4:* Use the `--vrde-address="0.0.0.0"` option.
- *Only IPv6:* Use the `--vrde-address="::"` option.
- *Both IPv6 and IPv4:* Use the `--vrde-address=""` option. This is the default value.

`--vrde-auth-type=null | external | guest`
Specify whether to use authorization and how to perform authorization. See RDP Authentication. Valid values are as follows:

- `null` provides no authentication.
- `external` provides external authentication through an authentication library.
- `guest` performs authentication by using guest user accounts. This unsupported method requires that you install the Guest Additions on the VM.

`--vrde-auth-library=default | ` *name*
Specifies the library to use for RDP authentication. The default library for external authentication is `VBoxAuth`. See RDP Authentication.

`--vrde-multi-con=on | off`
Enables or disables the multiple connections VRDE server feature, if supported. See Multiple Connections to the VRDP Server.

`--vrde-reuse-con=on | off`
Specifies how the VRDE server behaves when multiple connections are disabled. When the value is `on`, the server permits a new client to connect and drops the existing connection. When the value is `off`, a new connection is not accepted if a client is already connected to the server. This is the default value.

`--vrde-video-channel=on | off`
Enables video redirection if supported by the VRDE server. See VRDP Video Redirection.

`--vrde-video-channel-quality=` *percent*
Specifies the image quality for video redirection as a value from 10 to 100 percent. The percentage represents the JPEG compression level where a lower number diminishes quality and provides higher compression. See VRDP Video Redirection.

Teleporting Settings

```
VBoxManage modifyvm <uuid | vmname> [--teleporter=on | off]
[--teleporter-port=port] [--teleporter-address=address | empty]
[--teleporter-password=password] [--teleporter-password-file=filename |
stdin] [--cpuid-portability-level=level] [--cpuid-set=leaf [:subleaf]
eax ebx ecx edx] [--cpuid-remove=leaf [:subleaf]] [--cpuid-remove-all]
```

The following options enable you to configure a machine as a teleporting target. See Teleporting and the teleporting related entries in Potentially Insecure Operations.

`--teleporter=on | off`
Enables or disables the teleporter. When enabled, a machine starts up and waits to receive a teleporting request from the network instead of booting normally.
Teleporting requests are received on the port and address specified using the following parameters.

`--teleporter-port=` *port*
Specifies the port on which the VM listens to receive a teleporting request from another VM. *port* is any free TCP/IP port number, such as `6000`. You must also specify the `--teleporter` option.

`--teleporter-address=` *IP-address*
Specifies the IP address on which the VM listens to receive a teleporting request from another VM. *IP-address* is any IP address or host name and specifies the TCP/IP socket on which to bind. The default IP address is `0.0.0.0`, which represents any IP address. You must also specify the `--teleporter` option.

`--teleporter-password=` *password*
Specifies the password to use for authentication. When specified, the teleporting request only succeeds if the password on the source machine is the same password as the one you specify.

`--teleporter-password-file=` *filename*
Specifies a file that contains the password to use for authentication. When specified, the teleporting request only succeeds if the password on the source machine is the same password as the one you specify in the password file. A value of `stdin` reads the password from standard input.

`--cpuid-portability-level=` *level*
Restricts the virtual CPU capabilities that Oracle VM VirtualBox presents to the guest OS by using portability rules. Higher integer values designate more restrictive behavior. The default level of `0` indicates that all virtualized features supported by the host are made available to the guest. The value `3` supresses most features. Values of `1` and `2` represent restrictions in between. The behavior may change depending on the product version.

`--cpuid-set=` *leaf* `[:` *subleaf* `]` *eax ebx ecx edx*
Advanced users can use this setting before a teleporting operation (in fact before starting the VM) to restrict the virtual CPU capabilities that Oracle VM VirtualBox presents to the guest operating system. This must be run on both the source and the target machines involved in teleporting and will then modify what the guest sees when it executes the CPUID machine instruction. This might help with misbehaving applications that wrongly assume that certain CPU capabilities are present. The meaning of the parameters is hardware dependent. Refer to the AMD or Intel processor documentation.
The values of *leaf*, *subleaf* (optional), *eax*, *ebx*, *ecx* and *edx* are integers given in hexadecimal format, i.e. using a radix (base) of 16 without requiring any prefix.

`--cpuid-remove=` *leaf* `[:` *subleaf* `]`
Removes an adjustment established with `--cpuid-set`.

`--cpuid-remove-all`
Removes all adjustments established with `--cpuid-set`.

Debugging Settings

```
VBoxManage modifyvm <uuid | vmname> [--tracing-enabled=on | off]
[--tracing-config=string] [--tracing-allow-vm-access=on | off]
```

Only use the following options to perform low-level VM debugging. These options are for advanced users only.

`--tracing-enabled=on | off`
Enables or disables the trace buffer. Note that when specified, the trace buffer consumes some memory and adds overhead.

`--tracing-config=` *config-string*
Enables a tracing configuration that defines which group of trace points are enabled.

`--tracing-allow-vm-access=on | off`
Enables or disables VM access to the trace buffer. The default value is `off`, which disables access.

USB Card Reader Settings

```
VBoxManage modifyvm <uuid | vmname> [--usb-card-reader=on | off]
```

The following options specify the access to a USB Card Reader by the guest environment. A USB card reader can access data on memory cards, such as CompactFlash (CF), Secure Digital (SD), and MultiMediaCard (MMC).

--usb-card-reader=on | off
Enables or disables the USB card reader interface.

Autostarting VMs During Host System Boot

The following options enable you to configure the VM autostart feature, which automatically starts the VM at host system boot-up. You must do some host system configuration before you can use this feature. See Starting Virtual Machines During System Boot.

```
VBoxManage modifyvm <uuid | vmname> [--autostart-enabled=on | off]
[--autostart-delay=seconds]
```

--autostart-enabled=on | off
Enables or disables VM autostart at host system boot-up for the specified users.

--autostart-delay= *seconds*
Specifies the number of seconds after host system boot-up to autostart the VM.

Guest Debugging

These options are for configuring the VMM for guest debugging.

```
VBoxManage modifyvm <uuid | vmname> [--guest-debug-provider=none |
native | gdb | kd] [--guest-debug-io-provider=none | tcp | udp | ipc]
[--guest-debug-address=IP-Address | path] [--guest-debug-port=port]
```

--guest-debug-provider=none | native | gdb | kd
Selects the given debug stub provider.

--guest-debug-io-provider=none | tcp | udp | ipc
Selects the given I/O transport backend for the selected provider.

--guest-debug-address= *IP-Address* | *path*
Sets the path the debugger is accessible under, depends on the selected I/O transport.

--guest-debug-port= *port*
Sets the port the debugger is accessible under, depends on the selected I/O transport.

PCI Passthrough Settings

The following options enable you to configure the PCI passthrough feature, which currently is not available in Oracle VM VirtualBox. It is planned to bring this functionality back in the future.

```
VBoxManage modifyvm <uuid | vmname> [--pci-attach=host-PCI-address
[@guest-PCI-bus-address]] [--pci-detach=host-PCI-address]
```

`--pci-attach=` *host-PCI-address* `[@` *guest-PCI-bus-address* `]`
Attaches the specified PCI network controller on the host to the guest VM. You can optionally specify the PCI bus on the guest VM on which to attach the controller.

`--pci-detach=` *host-PCI-address*
Detaches the specified PCI network controller from the attached PCI bus on the guest VM.

Testing (ValidationKit / Bootsector)

These options are for configuring the testing functionality of the VMM device and almost exclusively used by the bootsector testcases in the ValidationKit.

```
VBoxManage modifyvm <uuid | vmname> [--testing-enabled=on | off]
[--testing-mmio=on | off] [--testing-cfg-dwordidx=value]
```

`--testing-enabled=on | off`
Enabled the testing functionality of the VMMDev. See VMMDevTesting.h for details.

`--testing-mmio=on | off`
Enabled the MMIO region of the VMMDev testing feature.

`--testing-cfg-dword` *idx* = *value*
This sets one of the 10 dword configuration values. The *idx* must be in the range 0 thru 9. The *value* is limited to 32 bits (dword).

Examples

The following command changes the description for the `ol7` VM.

```
$ VBoxManage modifyvm ol7 --description "Oracle Linux 7 with UEK4"
```

The following command enables VirtualBox Remote Display Protocol (VRDP) support for the `ol7` VM.

```
$ VBoxManage modifyvm ol7 --vrde on
```

See Also

VBoxManage showvminfo, VBoxManage controlvm, VBoxManage createvm, VBoxManage startvmVBoxManage list

VBoxManage movevm

Move a virtual machine to a new location on the host system

Synopsis

```
VBoxManage movevm <uuid | vmname> [--type=basic] [--folder=folder-name]
```

Description

The `VBoxManage movevm` command moves a virtual machine (VM) to a new location on the host system.

When moved, all of the files that are associated with the VM, such as settings files and disk image files, are moved to the new location. The Oracle VM VirtualBox configuration is updated automatically.

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or name of the VM to move.

`--type=basic`
Specifies the type of the move operation. So far `basic` is the only recognized value and also the default if not specified.

`--folder=` *folder-name*
Specifies a full path name or relative path name of the new location on the host file system. Not specifying the option or specifying the current location is allowed, and moves disk images and other parts of the VM to this location if they are currently in other locations.

Examples

The following command moves the `ol7` VM to a new location on the host system.

```
$ VBoxManage movevm ol7 --folder "/home/testuser/vms" --type basic
0%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
Machine has been successfully moved into /home/testuser/vms
```

VBoxManage natnetwork

Create, modify, and manage a NAT network

Synopsis

```
VBoxManage natnetwork add [--disable | --enable] <--netname=name>
<--network=network> [--dhcp=on|off] [--ipv6=on|off] [--loopback-4=rule]
[--loopback-6=rule] [--port-forward-4=rule] [--port-forward-6=rule]
```

```
VBoxManage natnetwork list [filter-pattern]
```

```
VBoxManage natnetwork modify [--dhcp=on|off] [--disable | --enable]
<--netname=name> <--network=network> [--ipv6=on|off] [--loopback-4=rule]
[--loopback-6=rule] [--port-forward-4=rule] [--port-forward-6=rule]
```

```
VBoxManage natnetwork remove <--netname=name>
```

```
VBoxManage natnetwork start <--netname=name>
```

```
VBoxManage natnetwork stop <--netname=name>
```

Description

The `VBoxManage natnetwork` command enables you to create, modify and manage a NAT network.

NAT networks use the Network Address Translation (NAT) service. The service groups systems into a network and prevents external systems from directly accessing the systems in the network. The service also enables the systems in the network to communicate with each other and with external systems by means of TCP and UDP over IPv4 and IPv6.

A NAT service is attached to an internal network. For a VM to use the NAT service, you must attach the VM to the internal network. Specify the name of the internal network when you create the NAT service. Note that the internal network is created if it does not already exist.

Add a NAT Network Service

```
VBoxManage natnetwork add [--disable | --enable] <--netname=name>
<--network=network> [--dhcp=on|off] [--ipv6=on|off] [--loopback-4=rule]
[--loopback-6=rule] [--port-forward-4=rule] [--port-forward-6=rule]
```

The `VBoxManage natnetwork add` command creates a new internal network interface, and adds a NAT network service. You must use this command before you can attach the VM to the NAT network.

`--disable`
Disables the NAT network service.

`--enable`
Enables the NAT network service.

`--netname=` *`name`*
Specifies the name of the new internal network interface on the host OS.

`--network`
Specifies the static or DHCP network address and mask of the NAT service interface. By default, this value specifies the static network address.

`--dhcp`
Enables or disables the DHCP server that you specify by using the `--netname` option.

`--ipv6`
Enables or disables IPv6. By default, IPv6 is disabled and IPv4 is enabled.

`--loopback-4=` *rule*
Enables an IPv4 loopback interface by using the specified rule.

`--loopback-6=` *rule*
Enables an IPv6 loopback interface by using the specified rule.

`--port-forward-4=` *rule*
Enables IPv4 port forwarding by using the rule specified by *rule*.

`--port-forward-6=` *rule*
Enables IPv6 port forwarding by using the rule specified by *rule*.

Remove a NAT Network Service

```
VBoxManage natnetwork remove <--netname=name>
```

The `VBoxManage natnetwork remove` command removes the specified NAT network service.

`--netname=` *name*
Specifies the name of the NAT network service to remove.

Start a NAT Network Service

```
VBoxManage natnetwork start <--netname=name>
```

The `VBoxManage natnetwork start` command starts a NAT network service and any associated DHCP server.

`--netname=` *name*
Specifies the name of the NAT network service to start.

Stop a NAT Network Service

```
VBoxManage natnetwork stop <--netname=name>
```

The `VBoxManage natnetwork stop` command stops a NAT network service and any associated DHCP server.

`--netname=` *name*
Specifies the name of the NAT network service to stop.

List All NAT Network Services

```
VBoxManage natnetwork list [filter-pattern]
```

The `VBoxManage natnetwork list` command lists all NAT network services. You can use a pattern to show a subset of the NAT network services.

filter-pattern
Specifies an optional filtering pattern.

Modify the Settings of a NAT Network Service

```
VBoxManage natnetwork modify [--dhcp=on|off] [--disable | --enable]
<--netname=name> <--network=network> [--ipv6=on|off] [--loopback-4=rule]
[--loopback-6=rule] [--port-forward-4=rule] [--port-forward-6=rule]
```

The `VBoxManage natnetwork modify` command modifies the settings of an existing internal network interface.

`--disable`
Disables the NAT network service.

`--enable`
Enables the NAT network service.

`--netname=` *name*
Specifies the name of the new internal network interface on the host OS.

`--network`
Specifies the static or DHCP network address and mask of the NAT service interface. By default, this value specifies the static network address.

`--dhcp`
Enables or disables the DHCP server that you specify by using the `--netname` option.

`--ipv6`
Enables or disables IPv6. By default, IPv6 is disabled and IPv4 is enabled.

`--loopback-4=` *rule*
Enables an IPv4 loopback interface by using the specified rule.

`--loopback-6=` *rule*
Enables an IPv6 loopback interface by using the specified rule.

`--port-forward-4=` *rule*
Enables IPv4 port forwarding by using the rule specified by *rule*.

`--port-forward-6=` *rule*
Enables IPv6 port forwarding by using the rule specified by *rule*.

Examples

The following command shows how to create a NAT network for the `natnet1` internal network that uses the `192.168.15.0/24` network address and mask of the NAT service interface. In this static configuration, the gateway is assigned the `192.168.15.1` IP address by default. Note that this IP address is the next address after the network address that you specify with the `--network` option.

```
$ VBoxManage natnetwork add --netname natnet1 --network "192.168.15.0/24" --enable
```

The following command shows how to add a DHCP server to the `natnet1` NAT network after creation:

```
$ VBoxManage natnetwork modify --netname natnet1 --dhcp on
```

VBoxManage registervm

Register a virtual machine

Synopsis

`VBoxManage registervm` <*filename*> `--password`*file*

Description

The `VBoxManage registervm` command enables you to create a virtual machine (VM) by importing an XML machine configuration file into Oracle VM VirtualBox. The VM cannot have the same UUID as a VM that is already registered in Oracle VM VirtualBox. Ensure that the XML machine configuration file is in the machines folder prior to registration.

> **Note:**
>
> When you use the `VBoxManage createvm` command to create a VM, you can specify the `--register` option to register the VM.

filename
Specifies the XML machine configuration file. This file has the `.vbox` file extension.

`--password`
Use the `--password` to supply the encryption password of the VM. Either specify the absolute pathname of a password file on the host operating system, or `-` to prompt you for the password on the command line.

Examples

The following command registers a VM called `vm2`. The XML machine configuration file for the VM is located in the default machines folder.

```
$ VBoxManage registervm "/home/user/VirtualBox VMs/vm2/vm2.vbox"
```

See Also

VBoxManage createvm, VBoxManage unregistervm

VBoxManage setextradata

Set a keyword value that is associated with a virtual machine or configuration

Synopsis

```
VBoxManage setextradata <global | uuid | vmname> <keyword> [value]
```

Description

The `VBoxManage setextradata` command enables you to set a keyword value that is associated with a virtual machine (VM) or with an Oracle VM VirtualBox configuration.

`global`
Sets information about the configuration rather than a VM.

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or name of the VM.

keyword
Specifies the keyword for which to set its value.

value
Specifies the keyword value. Specifying no value removes the keyword.

Examples

The following command sets the `installdate` keyword value for the `Fedora5` VM to `2019.01.01`:

```
$ VBoxManage setextradata Fedora5 installdate 2019.01.01
```

The following command unsets the value of the `installdate` keyword for the `Fedora5` VM:

```
$ VBoxManage setextradata Fedora5 installdate
```

See Also

VBoxManage getextradata

VBoxManage setproperty

Change global settings

Synopsis

```
VBoxManage setproperty <property-name> <property-value>
```

Description

The `VBoxManage setproperty` command enables you to change global settings that affect the entire Oracle VM VirtualBox installation. Some of these settings correspond to the settings in the *Preferences* dialog in the VirtualBox Manager.

The following properties are available:

`autostartdbpath`
Specifies the path to the autostart database. Valid values are `null`, which disables the autostart database, or the name of the folder that contains the database. See Starting Virtual Machines During System Boot.

`defaultfrontend`
Specifies the global default VM frontend. Valid values are `default`, which specifies the default frontend, or the name of the frontend to use.

`hwvirtexclusive`
Specifies whether Oracle VM VirtualBox makes exclusive use of the Intel VT-x or AMD-V hardware virtualization extensions of the host system's processor. See Hardware Virtualization.
Valid values are as follows:

- `on` enables Oracle VM VirtualBox to make exclusive use of these extensions. This is the default value.
- `off` shares these extensions with other hypervisors that run simultaneously. Note that disabling this setting has negative performance implications.

`language`
Specifies the user language used to translate API messages. Valid values are `C`, which means no translation or language code in form either `ll` or `ll_CC`, where `ll` is language 2 letters code in lower case and `CC` is country 2 letter code in upper case.

`logginglevel`
Specifies the VBoxSVC release logging details. See http://www.virtualbox.org/wiki/VBoxLogging.

`loghistorycount`
Specifies the number of rotated VM logs to retain.

`machinefolder`
Specifies the default folder in which virtual machine (VM) definitions are stored. Valid values are `default`, which specifies the default storage folder, or the name of the folder to use. See Where Oracle VM VirtualBox Stores its Files.

`proxymode`
Configures the mode for an HTTP proxy server. Valid values are as follows:

manual
Configure the URL of a HTTP proxy server manually, using the `proxyurl` property value.

noproxy
Do not use an HTTP proxy server. A direct connection to the Internet is used.

system
Detect the proxy settings automatically for the host network. This is the default value.

proxyurl
Specifies the URL for an HTTP proxy server when you specify a manual proxy by setting the `proxymode` property to `manual`.

vrdeauthlibrary
Specifies which library to use when external authentication has been configured for a particular VM. Valid values are `default`, which specifies the default library, or the name of the library to use. See RDP Authentication.

vrdeextpack
Specifies the library that implements the VirtualBox Remote Desktop Extension (RDE). Valid values are `null`, which disables the RDE, or the name of the library to use.

websrvauthlibrary
Specifies which library the web service uses to authenticate users. Valid values are `default`, which specifies the default library, `null`, which disables authentication, or the name of the library to use. For information about the Oracle VM VirtualBox web service, see Oracle VM VirtualBox Programming Interfaces.

Examples

The following command configures Oracle VM VirtualBox to use the specified HTTP proxy server.

```
$ VBoxManage setproperty proxymode manual
$ VBoxManage setproperty proxyurl "http://myproxy.com:8080"
```

See Also

VBoxManage startvm

VBoxManage sharedfolder

Add and remove shared folders

Synopsis

```
VBoxManage sharedfolder add <uuid | vmname> <--name=name>
<--hostpath=hostpath> [--readonly] [--transient] [--automount]
[--auto-mount-point=path]
```

```
VBoxManage sharedfolder remove <uuid | vmname> <--name=name>
[--transient]
```

Description

Shared folders enable you to share data between the host system and guests. To use shared folders, you must first install the Oracle VM VirtualBox Guest Additions software on the guest OS.

The shared folder is associated with a share name and the full path name of the folder or directory on the host system. The share name is a unique name within the namespace of the host OS.

Add a Shared Folder

```
VBoxManage sharedfolder add <uuid | vmname> <--name=name>
<--hostpath=hostpath> [--readonly] [--transient] [--automount]
[--auto-mount-point=path]
```

The `VBoxManage sharedfolder add` command creates a shared folder. The folder you specify is on the host computer. When configured, the contents of the folder on the host system can be shared with the guest OS.

uuid* | *vmname
Specifies the name or UUID of the guest VM that shares a folder with the host system.

--name=*name*
Specifies the name of the share, which is a unique name within the namespace of the host OS.

--hostpath=*hostpath*
Specifies the absolute path of the folder or directory on the host OS to share with the guest OS.

--readonly
Specifies that the share has only read-only access to files at the host path.
By default, shared folders have read-write access to the files at the host path. However on Linux distributions, shared folders are mounted with 770 file permissions with the `root` user and the `vboxsf` group. By using this option, the file permissions become 700.

--transient
Specifies that the share is transient, which means that it can be added and removed at runtime and does not persist after the VM stops.

--automount
Specifies that the share is automatically mounted.

--auto-mount-point=*path*
Specifies the mount point of the share. This guest OS specific.

For Windows and OS/2 guest this must be an unused drive letter. If left blank (or if the drive letter is already in use), the last unused drive letter is used instead (i.e. searching from `Z:` thru `A:`).
For Linux, Solaris and other unix guest, it must be an absolute path like `/mnt/mysharedfolder`. If left empty the default location is `/media/sf_`*`sharename`*.

Remove a Shared Folder

```
VBoxManage sharedfolder remove <uuid | vmname> <--name=name>
[--transient]
```

The `VBoxManage sharedfolder remove` command removes a shared folder.

uuid* | *vmname
Specifies the name or UUID of the guest VM that shares a folder with the host system.

--name=*name*
Specifies the name of the share to remove.

--transient
Specifies that the share is transient, which means that it can be added and removed at runtime and does not persist after the VM stops.

Examples

The following command creates a shared folder called `o7share` for the `ol7` VM. The share is mounted automatically when the VM is started.

```
$ VBoxManage sharedfolder add ol7 --name ol7share --hostpath "/home/user/ol7share" --
automount
```

The following command removes the shared folder called `o7share` for the `ol7` VM.

```
$ VBoxManage sharedfolder remove ol7 --name ol7share
```

VBoxManage showmediuminfo

Show information about a medium

Synopsis

```
VBoxManage showmediuminfo [disk | dvd | floppy] <uuid | filename>
```

Description

The `VBoxManage showmediuminfo` command shows the following information about a medium:

- Size
- Size on disk
- Type
- In use by virtual machines (VMs)

The medium must be specified either by its UUID, if the medium is registered, or by its filename. Registered images can be listed using `VBoxManage list hdds`, `VBoxManage list dvds`, or `VBoxManage list floppies`, as appropriate.

For backward compatibility, you can also use the `showvdiinfo` command to obtain information about the medium.

`disk` | `dvd` | `floppy`
Specifies the type of medium. Valid values are `disk` (hard drive), `dvd`, or `floppy`.

uuid* | *filename
Specifies the Universally Unique Identifier (UUID) or absolute path name of the medium or image.
If the medium is registered, you can specify the UUID. You can also list registered images by using the `VBoxManage list hdds`, `VBoxManage list dvds`, or `VBoxManage list floppies` command.

Examples

The following command shows information about the `disk01.vdi` disk image:

```
$ VBoxManage showmediuminfo disk01.vdi
```

The following command shows information about the `floppy01.img` floppy disk image.

```
$ VBoxManage showmediuminfo floppy floppy01.img
```

See Also

VBoxManage list

VBoxManage showvminfo

Show configuration information or log file contents for a virtual machine

Synopsis

```
VBoxManage showvminfo <uuid | vmname> [--details] [--machinereadable]
[--password-id] [--password]
```

```
VBoxManage showvminfo <uuid | vmname> <--log=index> [--password-idid]
[--passwordfile|-]
```

Description

The `VBoxManage showvminfo` command outputs configuration information or log file contents for a specified virtual machine (VM).

Viewing Virtual Machine Information

```
VBoxManage showvminfo <uuid | vmname> [--details] [--machinereadable]
[--password-id] [--password]
```

The `VBoxManage showvminfo` command outputs information about the specified VM in a detailed format or in a machine-readable format.

The `VBoxManage showvminfo` command shows the same information for the specified VM in the same format as the `VBoxManage list vms --long` command.

`--details`
Includes detailed information about the VM.

`--machinereadable`
Specifies that the VM information be in a machine-readable format.

`--password-id` ***id***
Specifies password id of the VM if it is encrypted.

`--password` ***file*** **`|-`**
Specifies password of the VM if it is encrypted. Either specify the absolute pathname of a password file on the host operating system, or `-` to prompt you for the password.

Viewing Virtual Machine Log Contents

```
VBoxManage showvminfo <uuid | vmname> <--log=index> [--password-idid]
[--passwordfile|-]
```

The `VBoxManage showvminfo --log` command outputs the contents of one of the specified VM's log files.

`--log=` ***index***
Specifies a numerical index that identifies the log file.
The index value starts at `0`, which indicates the `VBox.log` file. An index value of `1` indicates the `VBoxHardening.log` file. Index values starting at `2` indicate other log files, such as the `VBox.log.1` file.

`--password-id` ***id***
Specifies password id of the VM if it is encrypted.

`--password` *file* `|-`
Specifies password of the VM if it is encrypted. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the password.

Examples

The following example shows typical output for this command:

```
$ VBoxManage showvminfo "Windows 10"
VirtualBox Command Line Management Interface Version version-number
Copyright (C) 2005-2023 Oracle and/or its affiliates

Name:            Windows 10
Groups:          /
Guest OS:        Windows 10 (64-bit)
UUID:            1bf3464d-57c6-4d49-92a9-a5cc3816b7e7
Config file:     /home/username/VirtualBox VMs/Windows 10/Windows 10.vbox
Snapshot folder: /home/username/VirtualBox VMs/Windows 10/Snapshots
Log folder:      /home/username/VirtualBox VMs/Windows 10/Logs
Hardware UUID:   1bf3464d-57c6-4d49-92a9-a5cc3816b7e7
Memory size:     2048MB
Page Fusion:     off
VRAM size:       12MB
CPU exec cap:    100%
...
```

The following example shows the information output in a machine-readable format, which shows the entries as a *property=value* string:

```
$ VBoxManage showvminfo "Windows 10" --machinereadable
...
groups="/"
ostype="Windows 10 (64-bit)"
UUID="1bf3464d-57c6-4d49-92a9-a5cc3816b7e7"
...
```

The following example shows the contents of the `VBox.log` log file:

```
$ VBoxManage showvminfo "Windows 10" --log 0
00:00:02.895106 VirtualBox VM 6.0.0_RC1 r127378 linux.amd64 (Dec 10 2018 17:16:06)
release log
00:00:02.895109 Log opened 2018-12-14T14:31:44.088259000Z
00:00:02.895111 Build Type: release
00:00:02.895115 OS Product: Linux
00:00:02.895117 OS Release: 4.1.12-61.1.22.el7uek.x86_64
00:00:02.895119 OS Version: #2 SMP Fri Dec 2 09:28:44 PST 2016
...
```

See Also

VBoxManage list

VBoxManage signova

Digitally sign an OVA

Synopsis

```
VBoxManage signova <ova> <--certificate=file> <--private-key=file>
[--private-key-password-file=password-file | --private-key-password=password]
[--digest-type=type] [--pkcs7 | --no-pkcs7] [--intermediate-cert=file]
[--force] [--verbose] [--quiet] [--dry-run]
```

Description

The `VBoxManage signova` command adds a digital signature to an OVA file.

ova
The OVA file to sign.

`--certificate=` *file*
File containing the certificate that the OVA should be signed with. This can either be in PEM format (base64) or DER (binary), the command will detect which.

`--private-key=` *file*
The file containing the private key. This can either be in PEM (base64) or DER (binary) format, the command will detect which.

`--private-key-password-file=` *password-file*
File containing the private key password.

`--private-key-password=` *password*
The private key password.

`--digest-type=` *type*
Select the cryptographic digest algorithm to use in the signing. Possible values: SHA-256 (default), SHA-512 and SHA-1.
Some older versions of OVFTool and other VMware produces may require `--digest-type=sha-1` to accept the OVA.

`--pkcs7`, `--no-pkcs7`
Enables or disables the creation of an additional PKCS#7/CMS signature. This is enabled by default.

`--intermediate-cert=` *file*
File containing an intermediary certificate that should be included in the optional PKCS#7/CMS signature. Like the others, the file can either be in PEM or DER format. This option can be repeated to add multiple intermediate certificates. This option implies the `--pkcs7` option.

`--force`
Overwrite existing signature if present. The default behaviour is to fail if the OVA is already signed.

`--dry-run`
Do not actually modify the OVA, just test-run the signing operation.

-v, --verbose, -q, --quiet
Controls the verbosity of the command execution. The `--verbose` option can be used multiple times to get more output.

VBoxManage snapshot

Manage virtual machine snapshots

Synopsis

```
VBoxManage snapshot <uuid | vmname>
```

```
VBoxManage snapshot <uuid | vmname> take <snapshot-name>
[--description=description] [--live] [--uniquename
Number,Timestamp,Space,Force]
```

```
VBoxManage snapshot <uuid | vmname> delete <snapshot-name>
```

```
VBoxManage snapshot <uuid | vmname> restore <snapshot-name>
```

```
VBoxManage snapshot <uuid | vmname> restorecurrent
```

```
VBoxManage snapshot <uuid | vmname> edit <snapshot-name | --current>
[--description=description] [--name=new-name]
```

```
VBoxManage snapshot <uuid | vmname> list [--details | --machinereadable]
```

```
VBoxManage snapshot <uuid | vmname> showvminfo <snapshot-name>
```

Description

The `VBoxManage snapshot` command manages snapshots.

Oracle VM VirtualBox uses the snapshot to capture the state of a virtual machine (VM). You can later use the snapshot to revert to the state described by the snapshot.

A snapshot is a complete copy of a VM's settings. If you take the snapshot while the VM is running, the snapshot also includes the VM's state file.

After you take a snapshot, Oracle VM VirtualBox creates a *differencing hard disk* for each normal hard disk that is associated with the host machine. When you restore a snapshot, Oracle VM VirtualBox uses these differencing files to quickly reset the contents of the VM's virtual hard disks.

For each `VBoxManage snapshot` command, you must specify the name or the universal unique identifier (UUID) of the VM for which you want to take a snapshot.

General Command Operand

uuid* | *vmname
Specifies the UUID or name of the VM.

Take a Snapshot of a Virtual Machine

```
VBoxManage snapshot <uuid | vmname> take <snapshot-name>
[--description=description] [--live] [--uniquename
Number,Timestamp,Space,Force]
```

The `VBoxManage snapshot take` command takes a snapshot of the current state of the VM. You must supply a name for the snapshot and can optionally supply a description. The new snapshot is inserted into the snapshots tree as a child of the current snapshot and then becomes the new current snapshot.

`--description=` *description*
Specifies a description of the snapshot.

`--live`
Specifies that the VM is not stopped while you create the snapshot. This operation is know as live snapshotting.

`--uniquename Number,Timestamp,Space,Force`
TBD.

snapshot-name
Specifies the name of the snapshot to create.

Delete a Snapshot

```
VBoxManage snapshot <uuid | vmname> delete <snapshot-name>
```

The `VBoxManage snapshot delete` command removes the specified snapshot.

The delete operation may take some time to finish. This is because the differencing images that are associated with the snapshot may need to be merged with their child differencing images.

snapshot-name
Specifies the UUID or name of the snapshot.

Restore a Snapshot

```
VBoxManage snapshot <uuid | vmname> restore <snapshot-name>
```

The `VBoxManage snapshot restore` command restores the specified snapshot. This operation resets the VM's settings and current state to that of the snapshot. The state of the VM on which you restore a snapshot is lost. When restored, the specified snapshot becomes the new current snapshot and subsequent snapshots are children of that snapshot.

snapshot-name
Specifies the UUID or name of the snapshot.

Restore the Current Snapshot

```
VBoxManage snapshot <uuid | vmname> restorecurrent
```

The `VBoxManage snapshot restorecurrent` command restores the current snapshot. The current snapshot is the one from which the current state is derived. This command is equivalent to using the `VBoxManage snapshot restore` command and specifying the name or UUID of the current snapshot.

Change the Name or Description of an Existing Snapshot

```
VBoxManage snapshot <uuid | vmname> edit <snapshot-name | --current>
[--description=description] [--name=new-name]
```

The `VBoxManage snapshot edit` command enables you to change the name or the description of a specified snapshot.

snapshot-name
Specifies the UUID or name of the snapshot to edit.
This option is mutually exclusive with the `--current` option.

`--current`
Specifies that you update the current version of the snapshot.
This option is mutually exclusive with a specific snapshot name or its UUID.

`--description=` *`description`*
Specifies a new description for the snapshot.

`--name=` *`new-name`*
Specifies a new name for the snapshot.

List the Snapshots

```
VBoxManage snapshot <uuid | vmname> list [--details | --machinereadable]
```

The `VBoxManage snapshot list` command lists all the snapshots for a VM.

`--details`
Specifies that the output shows detailed information about the snapshot.
This option is mutually exclusive with the `--machinereadable` option.

`--machinereadable`
Specifies that the output is shown in a machine-readable format.
This option is mutually exclusive with the `--details` option.

Show Information About a Snapshot's Settings

```
VBoxManage snapshot <uuid | vmname> showvminfo <snapshot-name>
```

The `VBoxManage snapshot showvminfo` command enables you to view the VM settings that are part of an existing snapshot.

`snapshot-name`
Specifies the UUID or name of the snapshot.

Examples

The following command creates a snapshot of the `ol7u4` VM. The snapshot is called `ol7u4-snap-001`. The command uses the `--description` option to provide a description of the snapshot contents.

```
$ VBoxManage snapshot ol7u4 take ol7u4-snap-001 \
--description="Oracle Linux 7.4"
```

The following command lists the snapshots for the `ol7u4` VM.

```
$ VBoxManage snapshot ol7u4 list
```

The following command changes the description for the `ol7u4-snap-001` snapshot of the `ol7u4` VM.

```
$ VBoxManage snapshot ol7u4 edit ol7u4-snap-001 \
--description="Oracle Linux 7.4 with UEK4 kernel"
```

The following command shows VM settings for the `ol7u1-snap-001` snapshot of the `ol7u4` VM.

```
$ VBoxManage snapshot ol7u4 showvminfo ol7u4-snap-001
Name:            ol7u4
Groups:          /
Guest OS:        Oracle (64-bit)
UUID:            43349d78-2ab3-4cb8-978f-0e755cd98090
Config file:     C:\Users\user1\VirtualBox VMs\ol7u4\ol7u4.vbox
...
Snapshots:

   Name: ol7u4-snap-001 (UUID: 1cffc37d-5c37-4b86-b9c5-a0f157a55f43)
   Description: Oracle Linux 7.4 with UEK4 kernel
```

VBoxManage startvm

Start a virtual machine

Synopsis

`VBoxManage startvm` [`--putenv=`*name*[`=`*value*]] [`--type=<gui|headless|sdl|separate>`] [`--password=`*file*] [`--password-id=`*password-identifier*] <*uuid* | *vmname*...>

Description

The `VBoxManage startvm` command starts an Oracle VM VirtualBox virtual machine (VM) that is in the Powered Off or Saved state.

uuid* | *vmname
Specifies the name or Universally Unique Identifier (UUID) of the VM.

`--putenv=` *name* = *value*
Assigns a value to an environment variable as a name-value pair. For example, VBOX_DISABLE_HOST_DISK_CACHE=1.
The short form of this option is `-E`.

`--type=gui | headless | sdl | separate`
Specifies the frontend used to start the VM.
You can use the `VBoxManage setproperty` command to set a global default value for the frontend. Alternatively, you can use the `VBoxManage modifyvm` command to specify a default frontend value for a specific VM. If neither a global or per-VM default value is set and you do not specify the `--type` option, then the VM opens in a window on the host desktop.
The `--type` option accepts the following values:

`gui`
Starts a VM in a graphical user interface (GUI) window. This is the default.

`headless`
Starts a VM for remote display only.

sdl
Starts a VM using the VBoxSDL frontend.

separate
Starts a VM with a detachable user interface (UI), which means that the VM runs headless with the UI in a separate process.
This is an experimental feature that lacks certain functionality, such as 3D acceleration.

--password
Use the `--password` to supply the encryption password. Either specify the absolute pathname of a password file on the host operating system, or - to prompt you for the password on the command line.

--password-id
Use the `--password-id` option to specify the id the password is supplied for.

> **Note:**
>
> If a VM fails to start with a particular frontend and the error information is inconclusive, consider starting the VM directly by running the frontend. This workaround might provide additional error information.

Examples

The following command starts the `ol7u6` VM:

```
$ VBoxManage startvm ol7u6
```

The following command starts the `ol7u6-mininstall` VM in headless mode.

```
$ VBoxManage startvm ol7u6-mininstall --type headless
```

See Also

VBoxHeadless, the Remote Desktop Server, VBoxManage setproperty, VBoxManage modifyvm.

VBoxManage storageattach

Attach, remove, and modify storage media used by a virtual machine

Synopsis

```
VBoxManage storageattach <uuid | vmname> <--storagectl=name>
[--bandwidthgroup=name | none] [--comment=text] [--device=number]
[--discard=on | off] [--encodedlun=lun] [--forceunmount]
[--hotpluggable=on | off] [--initiator=initiator] [--intnet] [--lun=lun]
[--medium=none | emptydrive | additions | uuid | filename | host:drive |
iscsi] [--mtype=normal | writethrough | immutable | shareable |
readonly | multiattach] [--nonrotational=on | off] [--passthrough=on |
off] [--passwordfile=file] [--password=password] [--port=number]
[--server=name | ip] [--setparentuuid=uuid] [--setuuid=uuid]
```

```
[--target=target] [--tempeject=on | off] [--tport=port] [--type=dvddrive |
fdd | hdd] [--username=username]
```

Description

The `VBoxManage storageattach` command enables you to manage a storage medium that you connected to a storage controller by using the `VBoxManage storagectl` command.

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or the name of the virtual machine (VM).

`--storagectl=` *name*
Specifies the name of the storage controller. Use the `VBoxManage showvminfo` command to list the storage controllers that are attached to the VM.

`--port=` *number*
Specifies the port number of the storage controller to modify. You must specify this option unless the storage controller has only a single port.

`--device=` *number*
Specifies the port's device number to modify. You must specify this option unless the storage controller has only one device per port.

`--type=dvddrive | fdd | hdd`
Specifies the drive type to which the medium is associated. Only omit this option if the medium type can be determined by using the `--medium` option or by information provided by an earlier medium attachment command.

`--medium=none | emptydrive | additions |` *uuid* `|` *filename* `| host:` *drive* `| iscsi`
Specifies one of the following values:

`none`
Removes any existing device from the specified slot.

`emptydrive`
For a virtual DVD or floppy drive only.
Makes the device slot behave like a removeable drive into which no media has been inserted.

`additions`
For a virtual DVD drive only.
Attaches the VirtualBox Guest Additions image to the specified device slot.

uuid
Specifies the UUID of a storage medium to attach to the specified device slot. The storage medium must already be known to Oracle VM VirtualBox, such as a storage medium that is attached to another VM. Use the `VBoxManage list` command to list media.

filename
Specifies the full path of an existing disk image to attach to the specified device slot. The disk image can be in ISO, RAW, VDI, VMDK, or other format.

`host:` *drive*
For a virtual DVD or floppy drive only.
Connects the specified device slot to the specified DVD or floppy drive on the host computer.

`iscsi`
For virtual hard disks only.
Specifies an iSCSI target for which you must specify additional information. See iSCSI Servers.

For removeable media such as floppies and DVDs, you can make configuration changes while a VM is running. Changes to devices or hard disk device slots require that the VM be powered off.

`--mtype=normal | writethrough | immutable | shareable | readonly | multiattach`
Specifies how this medium behaves with respect to snapshots and write operations. See Special Image Write Modes.

`--comment=` *text*
Specifies an optional description to store with the medium.

`--setuuid=` *uuid*
Modifies the UUID of a medium before attaching it to a VM.
This is an expert option. Inappropriate values might make the medium unusable or lead to broken VM configurations if another VM already refers to the same medium.
Using the `--setuuid=""` option assigns a new random UUID to an image, which can resolve duplicate UUID errors if you used a file copy utility to duplicate an image.

`--setparentuuid=` *uuid*
Modifies the parent UUID of a medium before attaching it to a VM.
This is an expert option. Inappropriate values might make the medium unusable or lead to broken VM configurations if another VM already refers to the same medium.

`--passthrough=on | off`
For a virtual DVD drive only.
Enables writing to a DVD. This feature is experimental, see CD/DVD Support.

`--tempeject=on | off`
For a virtual DVD drive only.
Specifies whether to permit a temporary guest-triggered medium eject operation. When set to `on`, you can eject a medium. The ability for a guest-triggered eject operation does not persist if the VM is powered off and restarted. So, when you set this option to `on` and the VM is restarted, the originally configured medium is still in the drive.

`--nonrotational=on | off`
Enables you to specify that the virtual hard disk is non-rotational. Some guest OSes, such as Windows 7 or later, treat such disks as solid state drives (SSDs) and do not perform disk fragmentation on them.

`--discard=on | off`
Specifies whether to enable the auto-discard feature for a virtual hard disk. When set to `on`, a VDI image is shrunk in response to a `trim` command from the guest OS.
The virtual hard disk must meet the following requirements:

- The disk format must be VDI.

- The size of the cleared area of the disk must be at least 1 MB.
- Ensure that the space being trimmed is at least a 1 MB contiguous block at a 1 MB boundary.

Consider running defragmentation commands as background cron jobs to save space. On Windows, run the `defrag.exe /D` command. On Linux, run the `btrfs filesystem defrag` command.

> **Note:**
>
> When you configure the guest OS to issue the `trim` command, the guest OS typically sees the disk as an SSD.
> Ext4 supports the `-o discard` mount option. Mac OS X might require additional settings. Windows 7, 8, and 10 automatically detect and support SSDs. The Linux `exFAT` driver from Samsung supports the `trim` command.

The Microsoft implementation of exFAT might not support this feature.
You can use other methods to issue trim commands. The Linux `fstrim` command is part of the `util-linux` package. Earlier solutions required you to zero out unused areas by using the `zerofree` or a similar command, and then to compact the disk. You can only perform these steps when the VM is offline.

`--bandwidthgroup=`*name*
Specifies the bandwidth group to use for the device. See Limiting Bandwidth for Disk Images.

`--forceunmount`
For a virtual DVD or floppy drive only.
Forcibly unmounts the DVD, CD, or floppy or mounts a new DVD, CD, or floppy even if the previous removable storage is locked by the guest for reading. See CD/DVD Support.

The following options are applicable when you specify the `--medium=iscsi` option:

`--server=`*hostname* | *IP-address*
Specifies the host name or IP address of the iSCSI target.

`--target=`*target*
Specifies the target name string, which is determined by the iSCSI target and is used to identify the storage resource.

`--tport=`*port*
Specifies the TCP/IP port number of the iSCSI service on the target.

`--lun=`*LUN*
Specifies the logical unit number (LUN) of the target resource. For a single disk drive, the value is zero.

`--encodedlun=`*LUN*
Specifies the hexadecimal-encoded of the target resource. For a single disk drive, the value is zero.

`--username=`*username*
Specifies the user name to use for target authentication.

> **Note:**
>
> Unless you provide a settings password, the user name is stored as clear text in the XML machine configuration file.

`--password=` *password*
Specifies the password used for target authentication.

> **Note:**
>
> Unless you provide a settings password, this password is stored as clear text in the XML machine configuration file. When you specify a settings password for the first time, the target authentication password is stored in encrypted form.

`--passwordfile=` *password-filename*
Specifies a file that contains the target authentication password as clear text.

> **Note:**
>
> Use permission and ownership settings to ensure that the contents of this file cannot be read by unauthorized users.

`--initiator=` *initiator*
Specifies the iSCSI initiator.
The Microsoft iSCSI Initiator is a system, such as a server, that attaches to an IP network and initiates requests and receives responses from an iSCSI target. The SAN components in the iSCSI initiator are largely analogous to Fibre Channel SAN components, and they include the following:

- *iSCSI driver.* Transports blocks of iSCSI commands over the IP network. This iSCSI driver is installed on the iSCSI host and is included with the Microsoft iSCSI Initiator.
- *Gigabit Ethernet adapter.* Connects to an iSCSI target. Use an Ethernet adapter that can transmit 1000 megabits per second (Mbps). Like standard 10/100 adapters, most gigabit adapters use a preexisting Category 5 or Category 6E cable. Each port on the adapter is identified by a unique IP address.
- *iSCSI target.* Is any device that receives iSCSI commands. The device can be an end node such as a storage device, or it can be an intermediate device such as a network bridge between IP and Fibre Channel devices. Each port on the storage array controller or network bridge is identified by one or more IP addresses.

`--intnet`
Specifies whether to connect to the iSCSI target that uses internal networking. This configuration requires further configuration. See Access iSCSI Targets Using Internal Networking.

Examples

The following command attaches the `o7.vdi` disk image to the specified SATA storage controller on the `ol7` VM.

```
$ storageattach ol7 --storagectl "SATA Controller" --port 0 --device 0 \
--type hdd --medium /VirtualBox/ol7/ol7.vdi
```

The following command attaches the `o7-r6-dvd.iso` DVD image to the specified IDE storage controller on the `ol7` VM.

```
$ VBoxManage storageattach ol7 --storagectl "IDE Controller" --port 0 --device 0 \
--type dvddrive --medium ol7-r6-dvd.iso
```

See Also

VBoxManage list, VBoxManage showvminfo, VBoxManage storagectl

VBoxManage storagectl

Manage a storage controller

Synopsis

`VBoxManage storagectl` <*uuid* | *vmname*> <`--name=`*controller-name*> [`--add=floppy | ide | pcie | sas | sata | scsi | usb`] [`--controller=BusLogic | I82078 | ICH6 | IntelAhci | LSILogic | LSILogicSAS | NVMe | PIIX3 | PIIX4 | USB | VirtIO`] [`--bootable=on | off`] [`--hostiocache=on | off`] [`--portcount=`*count*] [`--remove`] [`--rename=`*new-controller-name*]

Description

The `VBoxManage storagectl` command enables you to attach, modify, and remove a storage controller. After you configure the storage controller, you can use the `VBoxManage storageattach` command to attach virtual media to the controller.

uuid* | *vmname
Specifies the Universally Unique Identifier (UUID) or name of the virtual machine (VM).

`--name=` ***controller-name***
Specifies the name of the storage controller.

`--add=` ***system-bus-type***
Specifies the type of the system bus to which to connect the storage controller. Valid values are `floppy`, `ide`, `pcie`, `sas`, `sata`, `scsi`, and `usb`.

`--controller=` ***chipset-type***
Specifies the chipset type to emulate for the specified storage controller. Valid values are `BusLogic`, `I82078`, `ICH6`, `IntelAHCI`, `LSILogic`, `LSILogicSAS`, `NVMe`, `PIIX3`, `PIIX4`, and `USB`. The default value varies, according to the type of storage controller.

`--portcount=` ***count***
Specifies the number of ports that the storage controller supports. Valid values depend on the type of storage controller.

`--hostiocache=on|off`
Specifies whether to use the host I/O cache for all disk images attached to this storage controller. Valid values are `on` and `off`. See Host Input/Output Caching.

`--bootable=on|off`
Specifies whether this controller is bootable. Valid values are `on` and `off`.

`--rename=` *new-controller-name*
Specifies a new name for the storage controller.

`--remove`
Removes a storage controller from the VM configuration.

Examples

The following command creates a SATA storage controller called `sata01` and adds it to the `ol7` VM. The storage controller emulates the IntelAHCI chipset.

```
$ VBoxManage storagectl ol7 --name "sata01" --add sata --controller IntelAHCI
```

The following command creates an IDE storage controller called `ide01` and adds it to the `ol7` VM.

```
$ VBoxManage storagectl ol7 --name "ide01" --add ide
```

See Also

VBoxManage storageattach

VBoxManage unattended

Unattended guest OS installation

Synopsis

```
VBoxManage unattended detect <--iso=install-iso> [--machine-readable]
```

```
VBoxManage unattended install <uuid | vmname> <--iso=install-iso>
[--user=login] [--password=password] [--password-file=file]
[--full-user-name=name] [--key=product-key] [--install-additions]
[--no-install-additions] [--additions-iso=add-iso] [--install-txs]
[--no-install-txs] [--validation-kit-iso=testing-iso] [--locale=ll_CC]
[--country=CC] [--time-zone=tz] [--hostname=fqdn]
[--package-selection-adjustment=keyword] [--dry-run]
[--auxiliary-base-path=path] [--image-index=number] [--script-template=file]
[--post-install-template=file] [--post-install-command=command]
[--extra-install-kernel-parameters=params] [--language=lang]
[--start-vm=session-type]
```

Description

unattended detect

```
VBoxManage unattended detect <--iso=install-iso> [--machine-readable]
```

Detects the guest operating system (OS) on the specified installation ISO and displays the result. This can be used as input when creating a VM for the ISO to be installed in.

`--iso=` *install-iso*
The installation ISO to run the detection on.

`--machine-readable`
Produce output that is simpler to parse from a script.

unattended install

```
VBoxManage unattended install <uuid | vmname> <--iso=install-iso>
[--user=login] [--password=password] [--password-file=file]
[--full-user-name=name] [--key=product-key] [--install-additions]
[--no-install-additions] [--additions-iso=add-iso] [--install-txs]
[--no-install-txs] [--validation-kit-iso=testing-iso] [--locale=ll_CC]
[--country=CC] [--time-zone=tz] [--hostname=fqdn]
[--package-selection-adjustment=keyword] [--dry-run]
[--auxiliary-base-path=path] [--image-index=number] [--script-template=file]
[--post-install-template=file] [--post-install-command=command]
[--extra-install-kernel-parameters=params] [--language=lang]
[--start-vm=session-type]
```

Reconfigures the specified VM for installation and optionally starts it up.

uuid* | *vmname
Either the UUID or the name (case sensitive) of a VM.

`--iso=` *install-iso*
The installation ISO to run the detection on.

`--user=` *login*
The login name. (default: vboxuser)

`--password=` *password*
The login password. This is used for the user given by `--user` as well as the root/administrator user. (default: changeme)

`--password-file=` *file*
Alternative to `--password` for providing the password. Special filename `stdin` can be used to read the password from standard input.

`--full-user-name=` *name*
The full user name. (default: --user)

`--key=` *product-key*
The guest OS product key. Not all guest OSes requires this.

`--install-additions`, `--no-install-additions`
Whether to install the VirtualBox guest additions. (default: --no-install-addations)

`--additions-iso=` *add-iso*
Path to the VirtualBox guest additions ISO. (default: installed/downloaded GAs)

`--install-txs`, `--no-install-txs`
Whether to install the test execution service (TXS) from the VirtualBox ValidationKit. This is useful when preparing VMs for testing or similar. (default: --no-install-txs)

`--validation-kit-iso=` *testing-iso*
Path to the VirtualBox ValidationKit ISO. This is required if `--install-txs` is specified.

`--locale=` *ll_CC*
The base locale specification for the guest, like en_US, de_CH, or nn_NO. (default: host or en_US)

`--country=` *CC*
The two letter country code if it differs from the specified by `--location`.

`--time-zone=` *tz*
The time zone to set up the guest OS with. (default: host time zone or UTC)

`--hostname=` *fqdn*
The fully qualified domain name of the guest machine. (default: *vmname*.myguest.virtualbox.org)

`--package-selection-adjustment=` *keyword*
Adjustments to the guest OS packages/components selection. This can be specfied more than once. Currently the only recognized keyword is `minimal` which triggers a minimal installation for some of the guest OSes.

`--dry-run`
Do not create any files or make any changes to the VM configuration.

`--start-vm=` *session-type*
Start the VM using the front end given by *session-type*. This is the same as the `--type` option for the `startvm` command, but we have add `none` for indicating that the VM should not be started. (default: `none`)

Advanced options:

`--auxiliary-base-path=` *path*
The path prefix to the media related files generated for the installation. (default: *vm-config-dir*/Unattended-*vm-uuid*-)

`--image-index=` *number*
Windows installation image index. (default: 1)

`--script-template=` ***file***
The unattended installation script template. (default: IMachine::OSTypeId dependent)

`--post-install-template=` ***file***
The post installation script template. (default: IMachine::OSTypeId dependent)

`--post-install-command=` ***command***
A single command to run after the installation is completed. The exact format and exactly when this is run is guest OS installer dependent.

`--extra-install-kernel-parameters=` ***params***
List of extra linux kernel parameters to use during the installation. (default: IMachine::OSTypeId dependent)

`--language=` ***lang***
Specifies the UI language for a Windows installation. The *lang* is generally on the form {ll}-{CC}. See detectedOSLanguages results from `VBoxManage unattended detect`. (default: detectedOSLanguages[0])

VBoxManage unregistervm

Unregister a virtual machine

Synopsis

```
VBoxManage unregistervm <uuid | vmname> [--delete] [--delete-all]
```

Description

The `VBoxManage unregistervm` command unregisters a virtual machine (VM).

uuid* | *vmname
Specifies the name or Universally Unique Identifier (UUID) of the VM.

`--delete`
Deletes the following files related to the VM automatically:

- All hard disk image files, including differencing files.
- All saved state files that the machine created, including one for each snapshot.
- XML VM machine definition file and its backups.
- VM log files.
- The empty directory associated with the unregistered VM.

`--delete-all`
Deletes the files described in the `--delete` option, as well as all DVDs and Floppy disks located in the VM folder and attached only to this VM.

Examples

The following command unregisters a VM called `vm2`.

```
$ VBoxManage unregistervm vm2
```

The following command unregisters a VM called `vm3`. All files associated with the VM are deleted.

```
$ VBoxManage unregistervm vm3 --delete
%...10%...20%...30%...40%...50%...60%...70%...80%...90%...100%
```

See Also

VBoxManage registervm

VBoxManage updatecheck

Checks for a newer version of VirtualBox

Synopsis

```
VBoxManage updatecheck perform [--machine-readable]
```

```
VBoxManage updatecheck list [--machine-readable]
```

```
VBoxManage updatecheck modify [--disable | --enable] [--channel=stable |
withbetas | all] [--frequency=days]
```

Description

The `updatecheck` subcommand is used to check if a newer version of VirtualBox is available. The two subcommand options of `updatecheck` are used for modifying or viewing the settings associated with checking for a newer version of VirtualBox.

updatecheck perform

```
VBoxManage updatecheck perform [--machine-readable]
```

Checks if a newer version of VirtualBox is available.

`--machine-readable`
Machine readable output.

updatecheck list

```
VBoxManage updatecheck list [--machine-readable]
```

Displays the current settings used for specifying when to check for a newer version of VirtualBox.

`--machine-readable`
Machine readable output.

updatecheck modify

```
VBoxManage updatecheck modify [--disable | --enable] [--channel=stable |
withbetas | all] [--frequency=days]
```

Modifies the settings used for specifying when to check for a newer version of VirtualBox.

`--enable`
Enable the update check service.

`--disable`
Disable the update check service.

`--channel=stable | withbetas | all`
The preferred release type used for determining whether a newer version of VirtualBox is available. The default is 'stable'.

`stable`
Checks for newer stable releases (maintenance and minor releases within the same major release) of VirtualBox.

`all`
Checks for newer stable releases (maintenance and minor releases within the same major release) and major releases of VirtualBox.

`withbetas`
Checks for newer stable releases (maintenance and minor releases within the same major release), major releases, and beta releases of VirtualBox.

`--frequency=days`
Specifies how often in days to check for a newer version of VirtualBox.

`--proxy-mode=system | manual | none`
Specifies the proxy mode to use.

`--proxy-url=<address>`
Specifies the proxy address to use. Set to empty string to clear proxy address.

VBoxManage usbdevsource

Add and remove USB device sources

Synopsis

```
VBoxManage usbdevsource add <source-name> <--backend=backend>
<--address=address>
```

```
VBoxManage usbdevsource remove <source-name>
```

Description

The `VBoxManage usbdevsource` command adds a USB device source and makes it available to the guests on the host system. You can also use this command to remove the USB device source.

Add a USB Device Source

```
VBoxManage usbdevsource add <source-name> <--backend=backend>
<--address=address>
```

The `VBoxManage usbdevsource add` command adds a USB device source, which is available to all guests on the host system.

source-name
Specifies a unique name for the USB device source.

--address=*address*
Specifies the address of the USB backend.

--backend=*backend*
Specifies the USB proxy service backend to use.
For now only USBIP is supported to specify a remote server using the USB/IP protocol.

Remove a USB Device

```
VBoxManage usbdevsource remove <source-name>
```

The `VBoxManage usbdevsource remove` command removes a USB device.

source-name
Specifies the name of the USB device source to remove.

Examples

The following command adds a USB device server called `hostusb01`.

```
$ VBoxManage usbdevsource add hostusb01 --backend USBIP --address 10.0.1.16
```

VBoxManage usbfilter

Manage USB filters

Synopsis

```
VBoxManage usbfilter add <index,0-N> <--target=<uuid | vmname | global>>
<--name=string> <--action=ignore | hold> [--active=yes | no]
[--vendorid=XXXX] [--productid=XXXX] [--revision=IIFF]
[--manufacturer=string] [--product=string] [--port=hex] [--remote=yes | no]
[--serialnumber=string] [--maskedinterfaces=XXXXXXXX]
```

```
VBoxManage usbfilter modify <index,0-N> <--target=<uuid | vmname |
global>> [--name=string] [--action=ignore | hold] [--active=yes | no]
[--vendorid=XXXX| ""] [--productid=XXXX| ""] [--revision=IIFF| ""]
[--manufacturer=string| ""] [--product=string| ""] [--port=hex] [--remote=yes
| no] [--serialnumber=string| ""] [--maskedinterfaces=XXXXXXXX]
```

```
VBoxManage usbfilter remove <index,0-N> <--target=<uuid | vmname |
global>>
```

Description

The `VBoxManage usbfilter` command enables you to manage USB filters for a specific virtual machine (VM), or global USB filters that affect the entire Oracle VM VirtualBox configuration.

Global filters are applied before VM-specific filters. This means that you can use a global filter to prevent devices from being captured by any VM.

Global filters are applied in a particular order. Only the first filter that fits a device is applied. For example, the first global filter makes a specific Kingston memory stick device available while the second filter ignores all Kingston devices. The result of applying these filters is that the specific Kingston memory stick is made available to any machine that has the appropriate filter, but no other Kingston devices are made available.

Common Operand and Options

index,0-*N*
Specifies a single integer that indicates the position of the filter in the list. Zero (`0`) represents the first position in the list. If a filter already exists at the specified position, the existing filter and any existing filters that follow are moved down the list. Otherwise, the new filter is appended to the list.

`--action=ignore | hold`
Specifies whether to permit VMs access to devices that fit the filter description (`hold`) or to deny them access (`ignore`). This option applies only to global filters.

`--active=yes | no`
Specifies whether the USB filter is active or temporarily disabled. Valid values are `yes`, which activates the filter, and `no`, which disables the filter. The default value is `yes`.

`--manufacturer=` *string*
Specifies a manufacturer ID filter as a string. The default value is an empty string (`""`).

`--maskedinterfaces=` *XXXXXXXX*
Specifies a masked interface filter that is used to hide one or more USB interfaces from the guest. The value is a bit mask where the set bits correspond to the USB interfaces to hide, or mask off. This feature is supported on Linux host systems only.

`--name=` *filter-name*
Specifies the name of the filter.

`--port=` *hex*
Specifies a hub port number filter as a string. The default value is an empty string (`""`).

`--product=` *string*
Specifies a product ID filter as a string. The default value is an empty string (`""`).

`--productid=` *XXXX*
Specifies a product ID filter. The string representation for an exact match has the form *XXXX*, where *X* is a hexadecimal digit including leading zeroes. The default value is an empty string (`""`).

`--remote=yes | no`
Specifies a remote filter that indicates whether the device is physically connected to a remote VRDE client or to a local host system. This option applies to VM filters only. The default value is an empty string (`""`).

`--revision=` *IIFF*
Specifies a revision ID filter. The string representation for an exact match has the form *IIFF*. *I* is a decimal digit of the integer part of the revision. *F* is a decimal digit of its fractional part that includes leading and trailing zeros. The default value is an empty string (`""`).
To specify a range of revision IDs, ensure that you use the hexadecimal form so that the revision is stored as a 16-bit packed BCD value. For example, the `int:0x0100-0x0199` expression matches any revision from 1.0 to 1.99, inclusive.

`--serialnumber=` *string*
Specifies a serial number filter as a string. The default value is an empty string (`""`).

`--target=`*`uuid`*` | `*`vmname`*` | global`
Specifies the VM that the filter is attached to. You can specify the Universally Unique Identifier (UUID) or the name of the VM. To apply the filter description to all VMs, specify `global`.

`--vendorid=`*`XXXX`
Specifies a vendor ID filter, which is a string representation of a four-digit hexadecimal number. *X* is the hexadecimal digit including leading zeroes. The default value is an empty string ("").

Add a USB Filter or a Global Filter

```
VBoxManage usbfilter add <index,0-N> <--target=<uuid | vmname | global>>
<--name=string> <--action=ignore | hold> [--active=yes | no]
[--vendorid=XXXX] [--productid=XXXX] [--revision=IIFF]
[--manufacturer=string] [--product=string] [--port=hex] [--remote=yes | no]
[--serialnumber=string] [--maskedinterfaces=XXXXXXXX]
```

Use the `VBoxManage usbfilter add` command to create a new USB filter.

In addition, specify parameters by which to filter. You can use the `VBoxManage list usbhost` command to view the parameters for devices that are attached to your system.

Modify a USB Filter or a Global Filter

```
VBoxManage usbfilter modify <index,0-N> <--target=<uuid | vmname |
global>> [--name=string] [--action=ignore | hold] [--active=yes | no]
[--vendorid=XXXX| ""] [--productid=XXXX| ""] [--revision=IIFF| ""]
[--manufacturer=string| ""] [--product=string| ""] [--port=hex] [--remote=yes
| no] [--serialnumber=string| ""] [--maskedinterfaces=XXXXXXXX]
```

Use the `VBoxManage usbfilter modify` command to modify a USB filter. You can use the `VBoxManage list usbfilters` command to list global filter indexes and the `VBoxManage showvminfo` command to list indexes for a specific machine.

Remove a USB Filter or a Global Filter

```
VBoxManage usbfilter remove <index,0-N> <--target=<uuid | vmname |
global>>
```

Use the `VBoxManage usbfilter remove` command to remove a USB filter entry.

Examples

The following command lists the available USB devices on the host system.

```
$ VBoxManage list usbhost
```

The following command adds a USB filter called `filter01` to the `ol7` VM. The filter specifies a Kingston DataTraveler memory stick and is placed first in the list of USB filters for the VM.

```
$ VBoxManage usbfilter add 0 --target ol7 --name filter01 --vendorid 0x0930 --productid
0x6545
```

The following command removes the USB filter that is second in the list for the `ol7` VM.

```
$ VBoxManage usbfilter remove 1 --target ol7
```

vboximg-mount

FUSE mount a virtual disk image for Mac OS and Linux hosts

Synopsis

```
vboximg-mount <-? | -h | --help>
```

```
vboximg-mount <--image=image-UUID> [--guest-filesystem] [-o=FUSE-option
[,FUSE-option...]] [--root] [--rw] <mountpoint>
```

```
vboximg-mount <--list> [--image=image-UUID] [--guest-filesystem]
[--verbose] [--vm=vm-UUID] [--wide]
```

Description

The `vboximg-mount` command enables you to make Oracle VM VirtualBox disk images available to a Mac OS or Linux host operating system (OS) for privileged or non-priviliged access. You can mount any version of the disk from its available history of snapshots. Use this command to mount, view, and optionally modify the contents of an Oracle VM VirtualBox virtual disk image, and you can also use this command to view information about registered virtual machines (VMs).

This command uses the Filesystem in Userspace (FUSE) technology to provide raw access to an Oracle VM VirtualBox virtual disk image.

When you use the `--image` option to specify a base image identifier, only the base image is mounted. Any related snapshots are disregarded. Alternatively, if you use the `--image` option to specify a snapshot, the state of the FUSE-mounted virtual disk is synthesized from the implied chain of snapshots, including the base image.

The `vboximg-mount` command includes experimental read-only access to file systems inside a VM disk image. This feature enables you to extract some files from the VM disk image without starting the VM and without requiring third-party file system drivers on the host system. Oracle VM VirtualBox supports the FAT, NTFS, `ext2`, `ext3`, and `ext4` file systems.

The virtual disk is exposed as a device node within a FUSE-based file system that overlays the specified mount point.

The FUSE file system includes a directory that contains a number of files. The file system can also contain a directory that includes a symbolic link that has the same base name (see the `basename`(1) man page) as the virtual disk base image and points to the location of the virtual disk base image. The directory can be of the following types:

- `vhdd` provides access to the raw disk image data as a flat image
- `vol`*ID* provides access to an individual volume on the specified disk image
- `fs`*ID* provides access to a supported file system without requiring a host file system driver

General Command Options

```
vboximg-mount <-? | -h | --help>
```

Use the following options to obtain information about the `vboximg-mount` command and its options.

`--help`, `--h`, or `--?`
Shows usage information.

Mounting an Oracle VM VirtualBox Disk Image

```
vboximg-mount <--image=image-UUID> [--guest-filesystem] [-o=FUSE-option
[,FUSE-option...]] [--root] [--rw] <mountpoint>
```

Use the `vboximg-mount` command to mount an Oracle VM VirtualBox virtual disk image on a Mac OS or Linux host system. When mounted, you can view the contents of the disk image or modify the contents of the disk image.

You can use the `vboximg-mount` command to restrict FUSE-based access to a subsection of the virtual disk.

`--image=` *disk-image*
Specifies the Universally Unique Identifier (UUID), name, or path of the Oracle VM VirtualBox disk image.
The short form of the `--image` option is `-i`.

`--guest-filesystem`
Enables experimental read-only support for guest file systems. When you specify this option, all known file systems are made available to access.
The short form of the `--guest-filesystem` option is `-g`.

`-o=` *FUSE-option* `[,` *FUSE-option* `...]`
Specifies FUSE mount options.
The `vboximg-mount` command enables you to use the FUSE mount options that are described in the `mount.fuse`(8) man page.

`--root`
Overrides the security measure that restricts file access to the file system owner by also granting file access to the `root` user.
Same as the `-o allow_root` option. See the `-o` option description.
This option is incompatible with the `-o allow_other` option.

`--rw`
Mounts the specified image as read-write, which is required if you want to modify its contents. By default, images are mounted as read-only.

mount-point
Specifies the path name of a directory on which to mount the Oracle VM VirtualBox disk image.

Viewing Oracle VM VirtualBox Disk Image Information

```
vboximg-mount <--list> [--image=image-UUID] [--guest-filesystem]
[--verbose] [--vm=vm-UUID] [--wide]
```

Use the `vboximg-mount` command to view information about registered VMs or an Oracle VM VirtualBox virtual disk image.

`--image=` *disk-image*
Specifies the UUID, name, or path of the Oracle VM VirtualBox disk image.
The short form of the `--image` option is `-i`.

`--guest-filesystem`
Enables experimental read-only support for guest file systems. When you specify this option, all known file systems are made available to access.
The short form of the `--guest-filesystem` option is `-g`.

`--list`
Shows information about the disks that are associated with the registered VMs. If you specify a disk image, this option shows information about the partitions of the specified image.
When you specify the `--verbose` option, the output includes detailed information about the VMs and media, including snapshot images and file paths.
The short form of the `--list` option is `-l`.

`--verbose`
Shows or logs detailed information.
The short form of the `--verbose` option is `-v`.

`--vm=` *vm-UUID*
Outputs information about the VM that is associated with the specified UUID.

`--wide`
Outputs information in a wide format. This output includes the lock state information of running VMs. For VMs that are not running, the state is `created`.
The wide output uses a tree-like structure in the VM column to show the relationship between a VM base image and its snapshots.

Examples

The following example shows how to mount a virtual disk image on the host operating system (OS).

```
$ mkdir fuse_mount_point
$ vboximg-mount --image=b490e578-08be-4f7d-98e9-4c0ef0952377 fuse_mount_point
$ ls fuse_mount_point
ubu.vdi[32256:2053029880]   vhdd
$ sudo mount fuse_mount_point/vhdd /mnt
```

The `mkdir` command creates a mount point called `fuse_mount_point` on the host OS. The `vboximg-mount` command is then used to mount the specified disk image on the `fuse_mount_point` mount point. The mount includes all snapshots for the disk image.

The `ls` command shows the contents of `fuse_mount_point`. The `mount` command is then used to mount the FUSE-mounted device node, `vhdd`, on the `/mnt` mount point. The `vhdd` device node represents the virtual disk image.

The following example shows how to make the known file systems of the `b490e578-08be-4f7d-98e9-4c0ef0952377` disk image accessible when the image is mounted on the `fuse_mount_point` mount point:

```
$ vboximg-mount --image=b490e578-08be-4f7d-98e9-4c0ef0952377 \
--guest-filesystem fuse_mount_point
```

The following command outputs detailed information about all registered VMs and their snapshots:

```
$ vboximg-mount --list --verbose
```

The following command shows an excerpt of the list output in wide format.

```
$ vboximg-mount --list --wide

VM  Image                  Size Type State   UUID (hierarchy)
-----------------------------------------  ------------------------------------
Proxy                                      0833f5bc-6304-42e1-b799-cdc81c576c60
 |
 +- Proxy.vdi              4.8G VDI  rlock   d5f84afb-0794-4952-ab71-6bbcbee07737
 |  +- <snapshot>         12.3G VDI  rlock     dffc67aa-3023-477f-8033-b27e3daf4f54
 |  +- <snapshot>          8.8G VDI  rlock       3b2755bd-5f2a-4171-98fe-647d510b6274
 |  +- <snapshot>         14.6G VDI  rlock         e2ccdb5f-49e8-4123-8623-c61f363cc5cf
 |  +- <snapshot>          7.4G VDI  wlock           3c1e6794-9091-4be3-9e80-11aba40c2649

-----------------------------------------  ------------------------------------
Oracle Linux 7                             5365ab5f-470d-44c0-9863-dad532ee5905
 |
 +- Oracle Linux 7.vdi     7.0G VDI created 96d2e92e-0d4e-46ab-a0f1-008fdbf997e7
 | +- <snapshot>          15.9G VDI created   f9cc866a-9166-42e9-a503-bbfe9b7312e8
 |
 +- kernel.vdi            11.1G VDI created 79a370bd-0c4f-480a-30bb-10cdea68423f
```

The output shows that the Proxy VM is running the fourth snapshot of the `Proxy.vdi` virtual disk image. The running state is indicated by the `wlock` value in the State column.

The Oracle Linux 7 VM is not running. It has two images: `Oracle Linux 7.vdi` and `kernel.vdi`. The `Oracle Linux 7.vdi` image has a snapshot.

The following command shows information about the VM with the specified UUID:

```
$ vboximg-mount --list --vm=b1d5563b-2a5b-4013-89f1-26c81d6bbfa0
------------------------------------------------------------------------
VM:   ubu
UUID: b1d5563b-2a5b-4013-89f1-26c81d6bbfa0

  Image:   ubu.vdi
  UUID:    b490e578-08be-4f7d-98e9-4c0ef0952377

       Snapshot: 35afe1e0-0a51-44f3-a228-caf172f3306f
       Size:     12.1G

       Snapshot: 874279c1-4425-4282-ada8-a9c07c00bbf9
       Size:     13.6G

  Image:   kernel.vdi
  UUID:    79a370bd-6eb7-4dbf-8bc6-d29118f127e0
```

9 Advanced Topics

Automated Guest Logins

Oracle VM VirtualBox provides Guest Addition modules for Windows, Linux, and Oracle Solaris to enable automated logins on the guest.

When a guest operating system is running in a virtual machine, it might be desirable to perform coordinated and automated logins using credentials passed from the host. Credentials are user name, password, and domain name, where each value might be empty.

Automated Windows Guest Logins

Windows provides a modular system login subsystem, called Winlogon, which can be customized and extended by means of so-called GINA (Graphical Identification and Authentication) modules. In Windows Vista and later releases, the GINA modules were replaced with a new mechanism called credential providers. The Oracle VM VirtualBox Guest Additions for Windows come with both, a GINA and a credential provider module, and therefore enable any Windows guest to perform automated logins.

To activate the Oracle VM VirtualBox GINA or credential provider module, install the Guest Additions using the command line switch `/with_autologon`. All the following manual steps required for installing these modules will be then done by the installer.

To manually install the Oracle VM VirtualBox GINA module, extract the Guest Additions as shown in Manual File Extraction, and copy the `VBoxGINA.dll` file to the Windows `SYSTEM32` directory. In the registry, create the following key with a value of `VBoxGINA.dll`:

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon\GinaDLL
```

> **Note:**
>
> The Oracle VM VirtualBox GINA module is implemented as a wrapper around the `MSGINA.DLL` standard Windows GINA module. As a result, it might not work correctly with third-party GINA modules.

To manually install the Oracle VM VirtualBox credential provider module, extract the Guest Additions as shown in Manual File Extraction and copy the `VBoxCredProv.dll` file to the Windows `SYSTEM32` directory. In the registry, create the following keys:

```
HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\
Authentication\Credential Providers\{275D3BCC-22BB-4948-A7F6-3A3054EBA92B}

HKEY_CLASSES_ROOT\CLSID\{275D3BCC-22BB-4948-A7F6-3A3054EBA92B}

HKEY_CLASSES_ROOT\CLSID\{275D3BCC-22BB-4948-A7F6-3A3054EBA92B}\InprocServer32
```

All default values, the key named `Default`, must be set to `VBoxCredProv`.

Create the following string and assign it a value of `Apartment`.

```
HKEY_CLASSES_ROOT\CLSID\{275D3BCC-22BB-4948-A7F6-3A3054EBA92B}
\InprocServer32\ThreadingModel
```

To set credentials, use the following command on a *running* VM:

```
$ VBoxManage controlvm "Windows XP" setcredentials "John Doe" "secretpassword" "DOMTEST"
```

While the VM is running, the credentials can be queried by the Oracle VM VirtualBox login modules, GINA or credential provider, using the Oracle VM VirtualBox Guest Additions device driver. When Windows is in *logged out* mode, the login modules will constantly poll for credentials and if they are present, a login will be attempted. After retrieving the credentials, the login modules will erase them so that the above command will have to be repeated for subsequent logins.

For security reasons, credentials are not stored in any persistent manner and will be lost when the VM is reset. Also, the credentials are write-only. There is no way to retrieve the credentials from the host side. Credentials can be reset from the host side by setting empty values.

Depending on the Windows guest version, the following restrictions apply:

- For **Windows XP guests.** The login subsystem needs to be configured to use the classic login dialog, as the Oracle VM VirtualBox GINA module does not support the Windows XP-style welcome dialog.
- **Windows Vista, Windows 7, Windows 8, and Windows 10 guests.** The login subsystem does not support the so-called Secure Attention Sequence, `Ctrl+Alt+Del`. As a result, the guest's group policy settings need to be changed to not use the Secure Attention Sequence. Also, the user name given is only compared to the true user name, not the user friendly name. This means that when you rename a user, you still have to supply the original user name as Windows never renames user accounts internally.
- Automatic login handling of the built-in **Windows Remote Desktop Service**, formerly known as Terminal Services, is disabled by default. To enable it, create the following registry key with a `DWORD` value of `1`.

  ```
  HKEY_LOCAL_MACHINE\SOFTWARE\Oracle\VirtualBox Guest Additions\AutoLogon
  ```

The following command forces Oracle VM VirtualBox to keep the credentials after they were read by the guest and on VM reset:

```
$ VBoxManage setextradata "Windows XP" VBoxInternal/Devices/VMMDev/0/Config/
KeepCredentials 1
```

Note that this is a potential security risk, as a malicious application running on the guest could request this information using the proper interface.

Automated Linux and UNIX Guest Logins

Oracle VM VirtualBox provides a custom PAM module (Pluggable Authentication Module) which can be used to perform automated guest logins on platforms which support this framework. Virtually all modern Linux and UNIX distributions rely on PAM.

For automated logins on Ubuntu, or Ubuntu-derived, distributions using LightDM as the display manager. See Oracle VM VirtualBox Greeter for Ubuntu/LightDM.

The `pam_vbox.so` module itself *does not* do an actual verification of the credentials passed to the guest OS. Instead it relies on other modules such as `pam_unix.so` or `pam_unix2.so` down in the PAM stack to do the actual validation using the credentials retrieved by

pam_vbox.so. Therefore pam_vbox.so has to be on top of the authentication PAM service list.

> **Note:**
>
> The pam_vbox.so module only supports the auth primitive. Other primitives such as account, session, or password are not supported.

The pam_vbox.so module is shipped as part of the Guest Additions but it is not installed and/or activated on the guest OS by default. In order to install it, it has to be copied from /opt/VBoxGuestAdditions-*version*/other/ to the security modules directory. This is usually /lib/security/ on 32-bit Linux guests or /lib64/security/ on 64-bit Linux guests. Please refer to your guest OS documentation for the correct PAM module directory.

For example, to use pam_vbox.so with a Ubuntu Linux guest OS and the GNOME Desktop Manager (GDM) to log in users automatically with the credentials passed by the host, configure the guest OS as follows:

1. Copy the pam_vbox.so module to the security modules directory. In this case, /lib/security.
2. Edit the PAM configuration file for GDM, found at /etc/pam.d/gdm. Add the line auth requisite pam_vbox.so at the top. Additionally, in most Linux distributions there is a file called /etc/pam.d/common-auth. This file is included in many other services, like the GDM file mentioned above. There you also have to add the line auth requisite pam_vbox.so.
3. If authentication against the shadow database using pam_unix.so or pam_unix2.so is desired, the argument try_first_pass for pam_unix.so or use_first_pass for pam_unix2.so is needed in order to pass the credentials from the Oracle VM VirtualBox module to the shadow database authentication module. For Ubuntu, this needs to be added to /etc/pam.d/common-auth, to the end of the line referencing pam_unix.so. This argument tells the PAM module to use credentials already present in the stack, such as the ones provided by the Oracle VM VirtualBox PAM module.

> **Caution:**
>
> An incorrectly configured PAM stack can effectively prevent you from logging into your guest system.

To make deployment easier, you can pass the argument debug right after the pam_vbox.so statement. Debug log output will then be recorded using syslog.

> **Note:**
>
> By default, `pam_vbox` does not wait for credentials to arrive from the host. When a login prompt is shown, for example by GDM/KDM or the text console, and `pam_vbox` does not yet have credentials it does not wait until they arrive. Instead the next module in the PAM stack, depending on the PAM configuration, will have the chance for authentication.

`pam_vbox` supports various guest property parameters that are located in `/VirtualBox/GuestAdd/PAM/`. These parameters allow `pam_vbox` to wait for credentials to be provided by the host and optionally can show a message while waiting for those. The following guest properties can be set:

- `CredsWait`: Set to 1 if `pam_vbox` should start waiting until credentials arrive from the host. Until then no other authentication methods such as manually logging in will be available. If this property is empty or gets deleted no waiting for credentials will be performed and `pam_vbox` will act like before. This property must be set read-only for the guest (`RDONLYGUEST`).
- `CredsWaitAbort`: Aborts waiting for credentials when set to any value. Can be set from host and the guest.
- `CredsWaitTimeout`: Timeout, in seconds, to let `pam_vbox` wait for credentials to arrive. When no credentials arrive within this timeout, authentication of `pam_vbox` will be set to failed and the next PAM module in chain will be asked. If this property is not specified, set to 0 or an invalid value, an infinite timeout will be used. This property must be set read-only for the guest (`RDONLYGUEST`).

To customize `pam_vbox` further there are the following guest properties:

- `CredsMsgWaiting`: Custom message showed while pam_vbox is waiting for credentials from the host. This property must be set read-only for the guest (`RDONLYGUEST`).
- `CredsMsgWaitTimeout`: Custom message showed when waiting for credentials by `pam_vbox` has timed out. For example, they did not arrive within time. This property must be set read-only for the guest (`RDONLYGUEST`).

> **Note:**
>
> If a `pam_vbox` guest property does not have the correct flag set (`RDONLYGUEST`) the property is ignored and, depending on the property, a default value will be used. This can result in pam_vbox not waiting for credentials. Consult the appropriate syslog file for more information and use the `debug` option.

Oracle VM VirtualBox Greeter for Ubuntu/LightDM

Oracle VM VirtualBox comes with a greeter module, named `vbox-greeter`, that can be used with LightDM. LightDM is the default display manager for Ubuntu Linux and therefore can also be used for automated guest logins.

`vbox-greeter` does not need the `pam_vbox` module described in Automated Linux and UNIX Guest Loginsin order to function. It comes with its own authentication mechanism

provided by LightDM. However, to provide maximum flexibility both modules can be used together on the same guest.

As with the `pam_vbox` module, `vbox-greeter` is shipped as part of the Guest Additions but it is not installed or activated on the guest OS by default. To install `vbox-greeter` automatically upon Guest Additions installation, use the `--with-autologon` option when starting the `VBoxLinuxAdditions.run` file:

```
# ./VBoxLinuxAdditions.run -- --with-autologon
```

For manual or postponed installation, copy the `vbox-greeter.desktop` file from `/opt/VBoxGuestAdditions-`*`version`*`/other/` to the `xgreeters` directory, which is usually `/usr/share/xgreeters/`. See your guest OS documentation for the name of the correct LightDM greeter directory.

The `vbox-greeter` module is installed by the Oracle VM VirtualBox Guest Additions installer and is located in `/usr/sbin/`. To enable `vbox-greeter` as the standard greeter module, edit the file `/etc/lightdm/lightdm.conf` as follows:

```
[SeatDefaults]
greeter-session=vbox-greeter
```

> **Note:**
>
> - The LightDM server must be fully restarted in order for `vbox-greeter` to be used as the default greeter. As `root` on Ubuntu, run `service lightdm --full-restart` or restart the guest.
> - `vbox-greeter` is independent of the graphical session you choose, such as Gnome, KDE, or Unity. However, `vbox-greeter` does require FLTK 1.3 or later to implement its own user interface.

There are numerous guest properties which can be used to further customize the login experience. For automatically logging in users, the same guest properties apply as for `pam_vbox`. See Automated Linux and UNIX Guest Logins.

In addition to the previously mentioned guest properties, `vbox-greeter` enables you to further customize its user interface. The following guest properties are located in the `/VirtualBox/GuestAdd/Greeter/` directory:

- `HideRestart`: Set to 1 if `vbox-greeter` should hide the button to restart the guest. This property must be set read-only for the guest (`RDONLYGUEST`).
- `HideShutdown`: Set to 1 if `vbox-greeter` should hide the button to shutdown the guest. This property must be set read-only for the guest (`RDONLYGUEST`).
- `BannerPath`: Path to a `.PNG` file to use as a banner image on the top of the greeter. The image size must be 460 x 90 pixels, any bit depth. This property must be set read-only for the guest (`RDONLYGUEST`).
- `UseTheming`: Set to 1 for turning on the following theming options. This property must be set read-only for the guest (`RDONLYGUEST`).
- `Theme/BackgroundColor`: Hexadecimal RRGGBB color for the background. This property must be set read-only for the guest (`RDONLYGUEST`).

- `Theme/LogonDialog/HeaderColor`: Hexadecimal RRGGBB foreground color for the header text. This property must be set read-only for the guest (`RDONLYGUEST`).
- `Theme/LogonDialog/BackgroundColor`: Hexadecimal RRGGBB color for the login dialog background. This property must be set read-only for the guest (`RDONLYGUEST`).
- `Theme/LogonDialog/ButtonColor`: Hexadecimal RRGGBB background color for the login dialog button. This property must be set read-only for the guest (`RDONLYGUEST`).

> **Note:**
>
> The same restrictions for the guest properties above apply as for the ones specified in the `pam_vbox` section.

Advanced Configuration for Windows Guests

Automated Windows System Preparation

Microsoft offers a system preparation tool called Sysprep, to prepare a Windows system for deployment or redistribution. Some Windows releases include Sysprep on the installation medium, but the tool is also available for download from the Microsoft web site. In a standard For most Windows versions, Sysprep is included in a default installation. Sysprep mainly consists of an executable called `sysprep.exe` which is invoked by the user to put the Windows installation into preparation mode.

The Guest Additions offer a way to launch a system preparation on the guest operating system in an automated way, controlled from the host system. See Guest Control of Applications for details of how to use this feature with the special identifier `sysprep` as the program to execute, along with the user name `sysprep` and password `sysprep` for the credentials. Sysprep is then started with the required system rights.

> **Note:**
>
> Specifying the location of `sysprep.exe` is **not possible**. Instead the following paths are used, based on the Windows release:
>
> - `C:\sysprep\sysprep.exe` for Windows XP and earlier
> - `%WINDIR%\System32\sysprep\sysprep.exe` for Windows Vista and later
>
> The Guest Additions will automatically use the appropriate path to execute the system preparation tool.

Advanced Configuration for Linux and Oracle Solaris Guests

Manual Setup of Selected Guest Services on Linux

The Oracle VM VirtualBox Guest Additions contain several different drivers. If you do not want to configure them all, use the following command to install the Guest Additions:

```
$ sh ./VBoxLinuxAdditions.run no_setup
```

After running this script, run the `rcvboxadd setup` command as `root` to compile the kernel modules.

On some 64-bit guests, you must replace `lib` with `lib64`. On older guests that do not run the `udev` service, you must add the `vboxadd` service to the default runlevel to ensure that the modules are loaded.

To set up the time synchronization service, add the `vboxadd-service` service to the default runlevel. To set up the X11 and OpenGL part of the Guest Additions, run the `rcvboxadd-x11 setup` command. Note that you do not need to enable additional services.

Use the `rcvboxadd setup` to recompile the guest kernel modules.

After compilation, reboot your guest to ensure that the new modules are loaded.

Guest Graphics and Mouse Driver Setup in Depth

This section assumes that you are familiar with configuring the X.Org server using xorg.conf and optionally the newer mechanisms using hal or udev and xorg.conf.d. If not you can learn about them by studying the documentation which comes with X.Org.

The Oracle VM VirtualBox Guest Additions includes drivers for X.Org. By default these drivers are in the following directory:

`/opt/VBoxGuestAdditions-`*`version`*`/other/`

The correct versions for the X server are symbolically linked into the X.Org driver directories.

For graphics integration to work correctly, the X server must load the `vboxvideo` driver. Many recent X server versions look for it automatically if they see that they are running in Oracle VM VirtualBox. For an optimal user experience, the guest kernel drivers must be loaded and the Guest Additions tool `VBoxClient` must be running as a client in the X session.

For mouse integration to work correctly, the guest kernel drivers must be loaded. In addition, for legacy X servers the correct `vboxmouse` driver must be loaded and associated with `/dev/mouse` or `/dev/psaux`. For most guests, a driver for a PS/2 mouse must be loaded and the correct vboxmouse driver must be associated with `/dev/vboxguest`.

The Oracle VM VirtualBox guest graphics driver can use any graphics configuration for which the virtual resolution fits into the virtual video memory allocated to the virtual machine, minus a small amount used by the guest driver, as described in Display Settings. The driver will offer a range of standard modes at least up to the default guest resolution for all active guest monitors. The default mode can be changed by setting the output property VBOX_MODE to "<width>x<height>" for any guest monitor. When VBoxClient and the kernel drivers are active this is done automatically when the host requests a mode change. The driver for older versions can only receive new modes by querying the host for requests at regular intervals.

With legacy X Servers before version 1.3, you can also add your own modes to the X server configuration file. Add them to the "Modes" list in the "Display" subsection of the "Screen" section. For example, the following section has a custom 2048x800 resolution mode added:

```
Section "Screen"
        Identifier    "Default Screen"
        Device        "VirtualBox graphics card"
        Monitor       "Generic Monitor"
        DefaultDepth  24
        SubSection "Display"
                Depth         24
```

```
                Modes          "2048x800" "800x600" "640x480"
        EndSubSection
EndSection
```

CPU Hot-Plugging

With virtual machines running modern server operating systems, Oracle VM VirtualBox supports CPU hot-plugging.

On a physical computer CPU hot-plugging would mean that a CPU can be added or removed while the machine is running. Oracle VM VirtualBox supports adding and removing of virtual CPUs while a virtual machine is running.

CPU hot-plugging works only with guest operating systems that support the feature. So far this applies only to Linux and Windows Server. Windows supports only hot-add, while Linux supports hot-add and hot-remove. To use this feature with more than 8 CPUs, a 64-bit Linux guest is required.

CPU hot-plugging is done using the `VBoxManage` command-line interface. First, hot-plugging needs to be enabled for a virtual machine:

```
$ VBoxManage modifyvm VM-name --cpu-hotplug on
```

The `--cpus` option is used to specify the maximum number of CPUs that the virtual machine can have:

```
$ VBoxManage modifyvm VM-name --cpus 8
```

When the VM is off, you can then add and remove virtual CPUs with the `VBoxManage modifyvm --plug-cpu` and `VBoxManage modifyvm --unplug-cpu` commands, which take the number of the virtual CPU as a parameter, as follows:

```
$ VBoxManage modifyvm VM-name --plug-cpu 3
$ VBoxManage modifyvm VM-name --unplug-cpu 3
```

Note that CPU 0 can never be removed.

While the VM is running, CPUs can be added and removed with the `VBoxManage controlvm plugcpu` and `VBoxManage controlvm unplugcpu` commands instead, as follows:

```
$ VBoxManage controlvm VM-name plugcpu 3
$ VBoxManage controlvm VM-name unplugcpu 3
```

See VBoxManage modifyvm and VBoxManage controlvm for details.

With Linux guests, the following applies:

To prevent ejection while the CPU is still used it has to be ejected from within the guest before. The Linux Guest Additions contain a service which receives hot-remove events and ejects the CPU. Also, after a CPU is added to the VM it is not automatically used by Linux. The Linux Guest Additions service will take care of that if installed. If not a CPU can be started with the following command:

```
$ echo 1 > /sys/devices/system/cpu/cpu<id>/online
```

Webcam Passthrough

Using a Host Webcam in the Guest

Oracle VM VirtualBox includes a feature called *webcam passthrough*, which enables a guest to use a host webcam. This complements the general USB passthrough support which was the typical way of using host webcams in legacy releases. The webcam passthrough support can handle non-USB video sources in theory, but this is completely untested.

> **Note:**
>
> The webcam passthrough module is shipped as part of the Oracle VM VirtualBox Extension Pack, which must be installed separately. See Installing Oracle VM VirtualBox and Extension Packs.

The host webcam can be attached to the VM using the **Devices** menu in the VM menu bar. The **Webcams** menu contains a list of available video input devices on the host. Clicking on a webcam name attaches or detaches the corresponding host device.

The `VBoxManage` command line tool can be used to enable webcam passthrough. Please see the host-specific sections below for additional details. The following commands are available:

- Get a list of host webcams, or other video input devices:

  ```
  $ VBoxManage list webcams
  ```

  The output format is as follows:

  ```
  alias "user friendly name"
  host path or identifier
  ```

  The alias can be used as a shortcut in other commands. Alias '.0' means the default video input device on the host. Alias '.1', '.2'means first, second video input device, and so on. The device order is host-specific.

- Attach a webcam to a running VM, as follows:

  ```
  VBoxManage controlvm VM name webcam attach [host_path|alias [settings]]
  ```

  This attaches a USB webcam device to the guest.

  The `settings` parameter is a string `Setting1=Value1;Setting2=Value2`, which enables you to configure the emulated webcam device. The following settings are supported:

  - `MaxFramerate`: The highest rate at which video frames are sent to the guest. A higher frame rate requires more CPU power. Therefore sometimes it is useful to set a lower limit. Default is no limit and allow the guest to use all frame rates supported by the host webcam.
  - `MaxPayloadTransferSize`: How many bytes the emulated webcam can send to the guest at a time. Default value is 3060 bytes, which is used by some webcams. Higher values can slightly reduce CPU load, if the guest is able to use larger buffers. However, a high `MaxPayloadTransferSize` might be not supported by some guests.

- Detach a webcam from a running VM, as follows:

```
VBoxManage controlvm VM-name webcam detach [host_path|alias]
```

- List the webcams attached to a running VM, as follows:

  ```
  VBoxManage controlvm VM-name webcam list
  ```

  The output contains the path or alias which was used in the `webcam attach` command for each attached webcam.

Windows Hosts

When the webcam device is detached from the host, the emulated webcam device is automatically detached from the guest.

macOS Hosts

When the webcam device is detached from the host, the emulated webcam device remains attached to the guest and must be manually detached using the `VBoxManage controlvm VM-name webcam detach` command.

Linux and Oracle Solaris Hosts

When the webcam is detached from the host the emulated webcam device is automatically detached from the guest only if the webcam is streaming video. If the emulated webcam is inactive it should be manually detached using the `VBoxManage controlvm VM-name webcam detach` command.

Aliases `.0` and `.1` are mapped to `/dev/video0`, alias `.2` is mapped to `/dev/video1` and so forth.

Advanced Display Configuration

Custom VESA Resolutions

Apart from the standard VESA resolutions, the Oracle VM VirtualBox VESA BIOS enables you to add up to 16 custom video modes which will be reported to the guest operating system. When using Windows guests with the Oracle VM VirtualBox Guest Additions, a custom graphics driver will be used instead of the fallback VESA solution so this information does not apply.

Additional video modes can be configured for each VM using the extra data facility. The extra data key is called `CustomVideoMode`*x* with *x* being a number from 1 to 16. Please note that modes will be read from 1 until either the following number is not defined or 16 is reached. The following example adds a video mode that corresponds to the native display resolution of many notebook computers:

```
$ VBoxManage setextradata VM-name "CustomVideoMode1" "1400x1050x16"
```

The VESA mode IDs for custom video modes start at `0x160`. In order to use the above defined custom video mode, the following command line has to be supplied to Linux:

```
vga = 0x200 | 0x160
vga = 864
```

For guest operating systems with Oracle VM VirtualBox Guest Additions, a custom video mode can be set using the video mode hint feature.

Configuring the Maximum Resolution of Guests When Using the Graphical Frontend

When guest systems with the Guest Additions installed are started using the graphical frontend, the normal Oracle VM VirtualBox application, they will not be allowed to use screen resolutions greater than the host's screen size unless the user manually resizes them by dragging the window, switching to full screen or seamless mode or sending a video mode hint using `VBoxManage`. This behavior is what most users will want, but if you have different needs, you can change it by issuing one of the following commands from the command line:

- Remove all limits on guest resolutions.

  ```
  VBoxManage setextradata global GUI/MaxGuestResolution any
  ```

- Manually specify a maximum resolution.

  ```
  VBoxManage setextradata global GUI/MaxGuestResolution widthxheight
  ```

- Restore the default settings to all guest VMs.

  ```
  VBoxManage setextradata global GUI/MaxGuestResolution auto
  ```

Advanced Storage Configuration

Using a Raw Host Hard Disk From a Guest

As an alternative to using virtual disk images as described in Virtual Storage, Oracle VM VirtualBox can also present either entire physical hard disks or selected partitions as virtual disks to virtual machines.

With Oracle VM VirtualBox, this type of access is called *raw hard disk access*. It enables a guest operating system to access its virtual hard disk without going through the host OS file system. The actual performance difference for image files compared to raw disk varies greatly depending on the overhead of the host file system, whether dynamically growing images are used, and on host OS caching strategies. The caching indirectly also affects other aspects such as failure behavior. For example, whether the virtual disk contains all data written before a host OS crash. Consult your host OS documentation for details on this.

> **Caution:**
>
> Raw hard disk access is for expert users only. Incorrect use or use of an outdated configuration can lead to **total loss of data** on the physical disk. Most importantly, *do not* attempt to boot the partition with the currently running host operating system in a guest. This will lead to severe data corruption.

Raw hard disk access, both for entire disks and individual partitions, is implemented as part of the VMDK image format support. As a result, you will need to create a special VMDK image file which defines where the data will be stored. After creating such a special VMDK image, you can use it like a regular virtual disk image. For example, you can use the Virtual Media Manager, see The Virtual Media Manager, or `VBoxManage` to assign the image to a virtual machine.

Access to Entire Physical Hard Disk

While this variant is the simplest to set up, you must be aware that this will give a guest operating system direct and full access to an *entire physical disk*. If your *host* operating system is also booted from this disk, please take special care to not access the partition from the guest at all. On the positive side, the physical disk can be repartitioned in arbitrary ways without having to recreate the image file that gives access to the raw disk.

On a Linux host, to create an image that represents an entire physical hard disk which will not contain any actual data, as this will all be stored on the physical disk, use the following command:

```
$ VBoxManage createmedium disk --filename path-to-file.vmdk --format=VMDK
 --variant RawDisk --property RawDrive=/dev/sda
```

This creates the *`path-to-file`*`.vmdk` file image that must be an absolute path. All data is read and written from `/dev/sda`.

On a Windows host, instead of the above device specification, for example use `\\.\PhysicalDrive0`. On a macOS host, instead of the above device specification use for example `/dev/rdisk1`. Note that on Mac OS X you can only get access to an entire disk if no volume is mounted from it.

Creating the image requires read/write access for the given device. Read/write access is also later needed when using the image from a virtual machine. On some host platforms, such as Windows, raw disk access may be restricted and not permitted by the host OS in some situations.

Just like with regular disk images, this does not automatically attach the newly created image to a virtual machine. This can be done as follows:

```
$ VBoxManage storageattach WindowsXP --storagectl "IDE Controller" \
 --port 0 --device 0 --type hdd --medium path-to-file.vmdk
```

When this is done the selected virtual machine will boot from the specified physical disk.

Access to Individual Physical Hard Disk Partitions

This *raw partition support* is quite similar to the full hard disk access described above. However, in this case, any partitioning information will be stored inside the VMDK image. This means that you can install a different boot loader in the virtual hard disk without affecting the host's partitioning information. While the guest will be able to *see* all partitions that exist on the physical disk, access will be filtered in that reading from partitions for which no access is allowed the partitions will only yield zeroes, and all writes to them are ignored.

To create a special image for raw partition support, which will contain a small amount of data, on a Linux host, use the command:

```
$ VBoxManage createmedium disk --filename path-to-file.vmdk --format=VMDK
--variant RawDisk --property RawDrive=/dev/sda --property Partitions=1,5
```

The command is identical to the one for full hard disk access, except for the additional `--property` Partitions=1,5 parameter. This example would create the image *`path-to-file`*`.vmdk`, which must be absolute, and partitions 1 and 5 of `/dev/sda` would be made accessible to the guest.

Oracle VM VirtualBox uses the same partition numbering as your Linux host. As a result, the numbers given in the above example would refer to the first primary partition and the first logical drive in the extended partition, respectively.

On a Windows host, instead of the above device specification, use for example `\\.\PhysicalDrive0`. On a macOS host, instead of the above device specification use `/dev/rdisk1`, for example. Note that on OS X you can only use partitions which are not mounted. Unmount the respective disk first using *diskutil unmountDisk* `/dev/diskX` . Partition numbers are the same on Linux, Windows, and macOS hosts.

The numbers for the list of partitions can be taken from the output of the following command:

```
$ VBoxManage list hostdrives
```

The output lists available drives and their partitions with the partition types and sizes to give the user enough information to identify the partitions necessary for the guest.

Images which give access to individual partitions are specific to a particular host disk setup. You cannot transfer these images to another host. Also, whenever the host partitioning changes, the image *must be recreated*.

Creating the image requires read/write access for the given device. Read/write access is also later needed when using the image from a virtual machine. If this is not feasible, there is a special variant for raw partition access, currently only available on Linux hosts, that avoids having to give the current user access to the entire disk. To set up such an image, use:

```
$ VBoxManage createmedium disk --filename path-to-file.vmdk --format=VMDK
--variant RawDisk --property RawDrive=/dev/sda --property Partitions=1,5
--property Relative=1
```

When used from a virtual machine, the image will then refer not to the entire disk, but only to the individual partitions. In this example, `/dev/sda1` and `/dev/sda5`. As a consequence, read/write access is only required for the affected partitions, not for the entire disk. During creation however, read-only access to the entire disk is required to obtain the partitioning information.

In some configurations it may be necessary to change the MBR code of the created image. For example, to replace the Linux boot loader that is used on the host by another boot loader. This enables for example the guest to boot directly to Windows, while the host boots Linux from the "same" disk. For this purpose the `--property-file` BootSector=*path-to-file-with-boot-sector* parameter is provided. It specifies a file name from which to take the MBR code. The partition table is not modified at all, so a MBR file from a system with totally different partitioning can be used. An example of this is:

```
$ VBoxManage createmedium disk --filename path-to-file.vmdk --format=VMDK
--variant RawDisk --property RawDrive=/dev/sda --property Partitions=1,5
--property-file BootSector=winxp.mbr
```

The modified MBR will be stored inside the image, not on the host disk.

The created image can be attached to a storage controller in a VM configuration as usual.

Configuring the Hard Disk Vendor Product Data (VPD)

Oracle VM VirtualBox reports vendor product data for its virtual hard disks which consist of hard disk serial number, firmware revision and model number. These can be changed using the following commands:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/SerialNumber" "serial"
```

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/FirmwareRevision" "firmware"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/ModelNumber" "model"
```

The serial number is a 20 byte alphanumeric string, the firmware revision an 8 byte alphanumeric string and the model number a 40 byte alphanumeric string. Instead of Port0, referring to the first port, specify the desired SATA hard disk port.

The above commands apply to virtual machines with an AHCI (SATA) controller. The commands for virtual machines with an IDE controller are:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/piix3ide/0/Config/PrimaryMaster/SerialNumber" "serial"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/piix3ide/0/Config/PrimaryMaster/FirmwareRevision" "firmware"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/piix3ide/0/Config/PrimaryMaster/ModelNumber" "model"
```

For hard disks, you can mark the drive as having a non-rotational medium by using the following command:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/NonRotational" "1"
```

Additional three parameters are needed for CD/DVD drives to report the vendor product data:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/ATAPIVendorId" "vendor"
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/ATAPIProductId" "product"
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/ahci/0/Config/Port0/ATAPIRevision" "revision"
```

The vendor id is an 8 byte alphanumeric string, the product id an 16 byte alphanumeric string and the revision a 4 byte alphanumeric string. Instead of Port0, referring to the first port, specify the desired SATA hard disk port.

Access iSCSI Targets Using Internal Networking

As an experimental feature, Oracle VM VirtualBox enables access to an iSCSI target running in a virtual machine which is configured to use Internal Networking mode. See iSCSI Servers, Internal Networking, and VBoxManage storageattach.

The IP stack accessing Internal Networking must be configured in the virtual machine which accesses the iSCSI target. A free static IP and a MAC address not used by other virtual machines must be chosen. In the example below, adapt the name of the virtual machine, the MAC address, the IP configuration, and the Internal Networking name (MyIntNet) according to your needs. The following eight commands must first be issued:

```
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/Trusted 1
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/Config/MAC 08:00:27:01:02:0f
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/Config/IP 10.0.9.1
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/Config/Netmask 255.255.255.0
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/LUN#0/Driver IntNet
$ VBoxManage setextradata VM-name \
```

```
VBoxInternal/Devices/IntNetIP/0/LUN#0/Config/Network MyIntNet
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/LUN#0/Config/TrunkType 2
$ VBoxManage setextradata VM-name \
VBoxInternal/Devices/IntNetIP/0/LUN#0/Config/IsService 1
```

Finally the iSCSI disk must be attached with the `--intnet` option to tell the iSCSI initiator to use internal networking, as follows:

```
$ VBoxManage storageattach ... --medium iscsi --server 10.0.9.30 \
--target iqn.2008-12.com.sun:sampletarget --intnet
```

Compared to a regular iSCSI setup, the IP address of the target *must* be specified as a numeric IP address, as there is no DNS resolver for internal networking.

The virtual machine with the iSCSI target should be started before the VM using it is powered on. If a virtual machine using an iSCSI disk is started without having the iSCSI target powered up, it can take up to 200 seconds to detect this situation. The VM will fail to power up.

Fine Tuning the Oracle VM VirtualBox NAT Engine

Configuring the Address of a NAT Network Interface

In NAT mode, the guest network interface is assigned to the IPv4 range `10.0.x.0/24` by default where *x* corresponds to the instance of the NAT interface +2. So *x* is 2 when there is only one NAT instance active. In that case the guest is assigned to the address `10.0.2.15`, the gateway is set to `10.0.2.2` and the name server can be found at `10.0.2.3`.

If the NAT network needs to be changed, use the following command:

```
$ VBoxManage modifyvm VM-name \
--natnet1 "192.168/16"
```

This command would reserve the network addresses from `192.168.0.0` to `192.168.254.254` for the first NAT network instance of *VM-name* The guest IP would be assigned to `192.168.0.15` and the default gateway could be found at `192.168.0.2`.

Configuring the Boot Server (Next Server) of a NAT Network Interface

For network booting in NAT mode, by default Oracle VM VirtualBox uses a built-in TFTP server at the IP address 10.0.2.4. This default behavior should work fine for typical remote-booting scenarios. However, it is possible to change the boot server IP and the location of the boot image with the following commands:

```
$ VBoxManage modifyvm VM-name \
--nattftpserver1 10.0.2.2
$ VBoxManage modifyvm VM-name \
--nattftpfile1 /srv/tftp/boot/MyPXEBoot.pxe
```

Tuning TCP/IP Buffers for NAT

The Oracle VM VirtualBox NAT stack performance is often determined by its interaction with the host's TCP/IP stack and the size of several buffers, `SO_RCVBUF` and `SO_SNDBUF`. For certain setups users might want to adjust the buffer size for a better performance. This can by achieved using the following commands, where values are in kilobytes and can range from 8 to 1024:

```
$ VBoxManage modifyvm VM-name \
--natsettings1 16000,128,128,0,0
```

This example illustrates tuning the NAT settings. The first parameter is the MTU, then the size of the socket's send buffer and the size of the socket's receive buffer, the initial size of the TCP send window, and lastly the initial size of the TCP receive window. Note that specifying zero means fallback to the default value.

Each of these buffers has a default size of 64KB and default MTU is 1500.

Binding NAT Sockets to a Specific Interface

By default, Oracle VM VirtualBox's NAT engine will route TCP/IP packets through the default interface assigned by the host's TCP/IP stack. The technical reason for this is that the NAT engine uses sockets for communication. If you want to change this behavior, you can tell the NAT engine to bind to a particular IP address instead. For example, use the following command:

```
$ VBoxManage modifyvm VM-name \
--natbindip1 "10.45.0.2"
```

After this, all outgoing traffic will be sent through the interface with the IP address 10.45.0.2. Ensure that this interface is up and running before changing the NAT bind address.

Enabling DNS Proxy in NAT Mode

The NAT engine by default offers the same DNS servers to the guest that are configured on the host. In some scenarios, it can be desirable to hide the DNS server IPs from the guest, for example when this information can change on the host due to expiring DHCP leases. In this case, you can tell the NAT engine to act as DNS proxy using the following command:

```
$ VBoxManage modifyvm VM-name --natdnsproxy1 on
```

Using the Host's Resolver as a DNS Proxy in NAT Mode

For resolving network names, the DHCP server of the NAT engine offers a list of registered DNS servers of the host. If for some reason you need to hide this DNS server list and use the host's resolver settings, thereby forcing the Oracle VM VirtualBox NAT engine to intercept DNS requests and forward them to host's resolver, use the following command:

```
$ VBoxManage modifyvm VM-name --natdnshostresolver1 on
```

Note that this setting is similar to the DNS proxy mode, however whereas the proxy mode just forwards DNS requests to the appropriate servers, the resolver mode will interpret the DNS requests and use the host's DNS API to query the information and return it to the guest.

User-Defined Host Name Resolving

In some cases it might be useful to intercept the name resolving mechanism, providing a user-defined IP address on a particular DNS request. The intercepting mechanism enables the user to map not only a single host but domains and even more complex naming conventions if required.

The following command sets a rule for mapping a name to a specified IP:

```
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name-of-interception-rule/HostIP" IPv4
```

```
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name/HostName" hostname
```

The following command sets a rule for mapping a pattern name to a specified IP:

```
VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name/HostIP" IPv4

VBoxManage setextradata VM-name \
"VBoxInternal/Devices/{pcnet,e1000}/0/LUN#0/AttachedDriver/Config/HostResolverMappings/ \
unique-rule-name/HostNamePattern" hostpattern
```

The host name pattern can include the following wildcard characters: pipe (`|`), question mark (`?`), and asterisk (`*`).

This example demonstrates how to instruct the host-resolver mechanism to resolve all domain and probably some mirrors of www.blocked-site.info site with IP 127.0.0.1:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/e1000/0/LUN#0/AttachedDriver/Config/HostResolverMappings/
all_blocked_site/HostIP" 127.0.0.1
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/e1000/0/LUN#0/AttachedDriver/Config/HostResolverMappings/
all_blocked_site/HostNamePattern" "*.blocked-site.*|*.fb.org"
```

The host resolver mechanism should be enabled to use user-defined mapping rules, otherwise they do not have any effect.

Configuring Aliasing of the NAT Engine

By default, the NAT core uses aliasing and uses random ports when generating an alias for a connection. This works well for the most protocols like SSH, FTP and so on. Though some protocols might need a more transparent behavior or may depend on the real port number the packet was sent from. You can change the NAT mode by using the following commands:

```
$ VBoxManage modifyvm VM-name \
--nataliasmode1 proxyonly

$ VBoxManage modifyvm "Linux Guest" --nataliasmode1 sameports
```

The first example disables aliasing and switches NAT into transparent mode, the second example enforces preserving of port values. These modes can be combined if necessary.

Configuring the BIOS DMI Information

The DMI data that Oracle VM VirtualBox provides to guests can be changed for a specific VM. Use the following commands to configure the DMI BIOS information. In case your VM is configured to use EFI firmware you need to replace `pcbios` by `efi` in the keys.

- DMI BIOS information (type 0)

  ```
  $ VBoxManage setextradata VM-name \
  "VBoxInternal/Devices/pcbios/0/Config/DmiBIOSVendor"        "BIOS Vendor"
  $ VBoxManage setextradata VM-name \
  "VBoxInternal/Devices/pcbios/0/Config/DmiBIOSVersion"       "BIOS Version"
  ```

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSReleaseDate"   "BIOS Release Date"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSReleaseMajor"  1
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSReleaseMinor"  2
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSFirmwareMajor" 3
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBIOSFirmwareMinor" 4
```

- DMI system information (type 1)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemVendor"      "System Vendor"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemProduct"     "System Product"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemVersion"     "System Version"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemSerial"      "System Serial"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemSKU"         "System SKU"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemFamily"      "System Family"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemUuid" \
"9852bf98-b83c-49db-a8de-182c42c7226b"
```

- DMI board information (type 2)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardVendor"       "Board Vendor"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardProduct"      "Board Product"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardVersion"      "Board Version"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardSerial"       "Board Serial"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardAssetTag"     "Board Tag"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardLocInChass"   "Board Location"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiBoardBoardType"    10
```

- DMI system enclosure or chassis (type 3)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisVendor"     "Chassis Vendor"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisType"       3
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisVersion"    "Chassis Version"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisSerial"     "Chassis Serial"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiChassisAssetTag"   "Chassis Tag"
```

- DMI processor information (type 4)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiProcManufacturer"  "GenuineIntel"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiProcVersion"       "Pentium(R) III"
```

- DMI OEM strings (type 11)

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiOEMVBoxVer"        "vboxVer_1.2.3"
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiOEMVBoxRev"        "vboxRev_12345"
```

If a DMI string is not set, the default value of Oracle VM VirtualBox is used. To set an empty string use "<EMPTY>".

Note that in the above list, all quoted parameters (DmiBIOSVendor, DmiBIOSVersion but not DmiBIOSReleaseMajor) are expected to be strings. If such a string is a valid number, the parameter is treated as number and the VM will most probably refuse to start with an VERR_CFGM_NOT_STRING error. In that case, use "string:*value*". For example:

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/pcbios/0/Config/DmiSystemSerial"      "string:1234"
```

Changing this information can be necessary to provide the DMI information of the host to the guest to prevent Windows from asking for a new product key. On Linux hosts, the DMI BIOS information can be obtained with the following command:

```
$ dmidecode -t0
```

The DMI system information can be obtained as follows:

```
$ dmidecode -t1
```

Configuring Custom ACPI Tables

You can configure Oracle VM VirtualBox to present up to four custom ACPI tables to the guest. Use a command such as the following to configure custom ACPI tables. Note that CustomTable1, CustomTable2, and CustomTable3 are available in addition to CustomTable0.

```
$ VBoxManage setextradata VM-name \
"VBoxInternal/Devices/acpi/0/Config/CustomTable0" "/path-to-table.bin"
```

Configuring custom ACPI tables can for example avoid the need for asking for a new product key on Windows Vista, Windows 7, Windows 8 and later guests. On Linux hosts, one of the system's ACPI tables can be read from /sys/firmware/acpi/tables/.

Fine Tuning Timers and Time Synchronization

Configuring the Guest Time Stamp Counter (TSC) to Reflect Guest Execution

By default, Oracle VM VirtualBox keeps all sources of time visible to the guest synchronized to a single time source, the monotonic host time. This reflects the assumptions of many guest operating systems, which expect all time sources to reflect "wall clock" time. In special circumstances it may be useful however to make the time stamp counter (TSC) in the guest reflect the time actually spent executing the guest.

This special TSC handling mode can be enabled on a per-VM basis, and for best results must be used only in combination with hardware virtualization. To enable this mode use the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/TM/TSCTiedToExecution" 1
```

To revert to the default TSC handling mode use:

```
$ VBoxManage setextradata VM-name "VBoxInternal/TM/TSCTiedToExecution"
```

Note that if you use the special TSC handling mode with a guest operating system which is very strict about the consistency of time sources you may get a warning or error message about the timing inconsistency. It may also cause clocks to become unreliable with some guest operating systems depending on how they use the TSC.

Accelerate or Slow Down the Guest Clock

For certain purposes it can be useful to accelerate or to slow down the virtual guest clock. This can be achieved as follows:

```
$ VBoxManage setextradata VM-name "VBoxInternal/TM/WarpDrivePercentage" 200
```

The above example will double the speed of the guest clock while

```
$ VBoxManage setextradata VM-name "VBoxInternal/TM/WarpDrivePercentage" 50
```

will halve the speed of the guest clock. Note that changing the rate of the virtual clock can confuse the guest and can even lead to abnormal guest behavior. For instance, a higher clock rate means shorter timeouts for virtual devices with the result that a slightly increased response time of a virtual device due to an increased host load can cause guest failures. Note further that any time synchronization mechanism will frequently try to resynchronize the guest clock with the reference clock, which is the host clock if the Oracle VM VirtualBox Guest Additions are active. Therefore any time synchronization should be disabled if the rate of the guest clock is changed as described above. See Tuning the Guest Additions Time Synchronization Parameters.

Tuning the Guest Additions Time Synchronization Parameters

The Oracle VM VirtualBox Guest Additions ensure that the guest's system time is synchronized with the host time. There are several parameters which can be tuned. The parameters can be set for a specific VM using the following command:

```
$ VBoxManage guestproperty set VM-name "/VirtualBox/GuestAdd/VBoxService/property" value
```

property is one of the following:

`--timesync-interval`
Specifies the interval at which to synchronize the time with the host. The default is 10000 ms (10 seconds).

`--timesync-min-adjust`
The minimum absolute drift value measured in milliseconds to make adjustments for. The default is 1000 ms on OS/2 and 100 ms elsewhere.

`--timesync-latency-factor`
The factor to multiply the time query latency with to calculate the dynamic minimum adjust time. The default is 8 times, which means as follows:
Measure the time it takes to determine the host time, the guest has to contact the VM host service which may take some time. Multiply this value by 8 and do an adjustment only if the time difference between host and guest is bigger than this value. Do not do any time adjustment otherwise.

`--timesync-max-latency`
The max host timer query latency to accept. The default is 250 ms.

`--timesync-set-threshold`
The absolute drift threshold, given as milliseconds where to start setting the time instead of trying to smoothly adjust it. The default is 20 minutes.

`--timesync-set-start`
Set the time when starting the time sync service.

`--timesync-set-on-restore 0|1`
Set the time after the VM was restored from a saved state when passing 1 as parameter. This is the default. Disable by passing 0. In the latter case, the time will be adjusted smoothly, which can take a long time.

All these parameters can be specified as command line parameters to `VBoxService` as well.

Disabling the Guest Additions Time Synchronization

Once installed and started, the Oracle VM VirtualBox Guest Additions will try to synchronize the guest time with the host time. This can be prevented by forbidding the guest service from reading the host clock:

```
$ VBoxManage setextradata VM-name "VBoxInternal/Devices/VMMDev/0/Config/
GetHostTimeDisabled" 1
```

Installing the Alternate Bridged Networking Driver on Oracle Solaris 11 Hosts

Oracle VM VirtualBox includes a network filter driver that utilizes Oracle Solaris 11's Crossbow functionality. By default, this new driver is installed for Oracle Solaris 11 hosts that have support for it.

To force installation of the older STREAMS based network filter driver, execute as root the following command before installing the Oracle VM VirtualBox package:

```
$ touch /etc/vboxinst_vboxflt
```

To force installation of the Crossbow based network filter driver, execute as root the following command before installing the Oracle VM VirtualBox package:

```
$ touch /etc/vboxinst_vboxbow
```

To check which driver is currently being used by Oracle VM VirtualBox, execute:

```
$ modinfo | grep vbox
```

If the output contains "vboxbow", it indicates Oracle VM VirtualBox is using the Crossbow network filter driver, while the name "vboxflt" indicates usage of the older STREAMS network filter.

Oracle VM VirtualBox VNIC Templates for VLANs on Oracle Solaris 11 Hosts

Oracle VM VirtualBox supports Virtual Network Interface (VNIC) templates for configuring VMs over VLANs. An Oracle VM VirtualBox VNIC template is a VNIC whose name starts with `vboxvnic_template`. The string is case-sensitive.

On Oracle Solaris 11 hosts, when Crossbow-based bridged networking is used, a VNIC template may be used to specify the VLAN ID to use while bridging over a network link.

The following is an example of how to use a VNIC template to configure a VM over a VLAN. Create an Oracle VM VirtualBox VNIC template, by executing as root:

```
# dladm create-vnic -t -l nge0 -v 23 vboxvnic_template0
```

This will create a temporary VNIC template over interface `nge0` with the VLAN ID 23. To create VNIC templates that are persistent across host reboots, skip the `-t` parameter in the above command. You may check the current state of links using the following command:

```
$ dladm show-link
LINK        CLASS     MTU    STATE    BRIDGE     OVER
nge0        phys      1500   up       --         --
nge1        phys      1500   down     --         --
vboxvnic_template0 vnic 1500 up       --         nge0

$ dladm show-vnic
LINK         OVER         SPEED  MACADDRESS        MACADDRTYPE         VID
vboxvnic_template0 nge0   1000   2:8:20:25:12:75   random              23
```

Once the VNIC template is created, any VMs that need to be on VLAN 23 over the interface `nge0` can be configured to bridge using this VNIC template.

VNIC templates makes managing VMs on VLANs simpler and efficient. The VLAN details are not stored as part of every VM's configuration but rather inherited from the VNIC template while starting the VM. The VNIC template itself can be modified anytime using the `dladm` command.

VNIC templates can be created with additional properties such as bandwidth limits and CPU fanout. Refer to your Oracle Solaris network documentation for details. The additional properties are also applied to VMs which bridge using the VNIC template.

Configuring Multiple Host-Only Network Interfaces on Oracle Solaris Hosts

By default Oracle VM VirtualBox provides you with one host-only network interface. Adding more host-only network interfaces on Oracle Solaris hosts requires manual configuration. Here is how to add another host-only network interface.

Begin by stopping all running VMs. Then, unplumb the existing "vboxnet0" interface by execute the following command as root:

```
# ifconfig vboxnet0 unplumb
```

If you have several vboxnet interfaces, you will need to unplumb all of them. Once all vboxnet interfaces are unplumbed, remove the driver by executing the following command as root:

```
# rem_drv vboxnet
```

Edit the file `/platform/i86pc/kernel/drv/vboxnet.conf` and add a line for the new interface we want to add as shown below:

```
name="vboxnet" parent="pseudo" instance=1;
name="vboxnet" parent="pseudo" instance=2;
```

Add as many of these lines as required with each line having a unique instance number.

Next, reload the vboxnet driver by executing the following command as root:

```
# add_drv vboxnet
```

On Oracle Solaris 11.1 and newer hosts you may want to rename the default vanity interface name. To check what name has been assigned, execute:

```
$ dladm show-phys
LINK              MEDIA                STATE      SPEED  DUPLEX    DEVICE
net0              Ethernet             up         100    full      e1000g0
net2              Ethernet             up         1000   full      vboxnet1
net1              Ethernet             up         1000   full      vboxnet0
```

In the above example, we can rename "net2" to "vboxnet1" before proceeding to plumb the interface. This can be done by executing as root:

```
# dladm rename-link net2 vboxnet1
```

Now plumb all the interfaces using `ifconfig vboxnet`*X*` plumb`, where *X* would be 1 in this case. Once the interface is plumbed, it may be configured like any other network interface. Refer to the `ifconfig` documentation for further details.

To make the settings for the newly added interfaces persistent across reboots, you will need to edit the files `/etc/inet/netmasks`, and if you are using NWAM `/etc/nwam/llp` and add the appropriate entries to set the netmask and static IP for each of those interfaces. The Oracle VM VirtualBox installer only updates these configuration files for the one "vboxnet0" interface it creates by default.

Configuring the Oracle VM VirtualBox CoreDumper on Oracle Solaris Hosts

Oracle VM VirtualBox is capable of producing its own core files for extensive debugging when things go wrong. Currently this is only available on Oracle Solaris hosts.

The Oracle VM VirtualBox CoreDumper can be enabled using the following command:

```
$ VBoxManage setextradata VM-name VBoxInternal2/CoreDumpEnabled 1
```

You can specify which directory to use for core dumps with this command, as follows:

```
$ VBoxManage setextradata VM-name VBoxInternal2/CoreDumpDir path-to-directory
```

Make sure the directory you specify is on a volume with sufficient free space and that the Oracle VM VirtualBox process has sufficient permissions to write files to this directory. If you skip this command and do not specify any core dump directory, the current directory of the Oracle VM VirtualBox executable will be used. This would most likely fail when writing cores as they are protected with root permissions. It is recommended you explicitly set a core dump directory.

You must specify when the Oracle VM VirtualBox CoreDumper should be triggered. This is done using the following commands:

```
$ VBoxManage setextradata VM-name VBoxInternal2/CoreDumpReplaceSystemDump 1
$ VBoxManage setextradata VM-name VBoxInternal2/CoreDumpLive 1
```

At least one of the above two commands will have to be provided if you have enabled the Oracle VM VirtualBox CoreDumper.

Setting `CoreDumpReplaceSystemDump` sets up the VM to override the host's core dumping mechanism and in the event of any crash only the Oracle VM VirtualBox CoreDumper would produce the core file.

Setting `CoreDumpLive` sets up the VM to produce cores whenever the VM process receives a `SIGUSR2` signal. After producing the core file, the VM will not be terminated and will continue to run. You can thus take cores of the VM process using the following command:

```
$ kill -s SIGUSR2 VM-process-id
```

The Oracle VM VirtualBox CoreDumper creates core files of the form `core.vb.`*`process-name`*`.`*`process-ID`* such as `core.vb.VBoxHeadless.11321`.

Oracle VM VirtualBox and Oracle Solaris Kernel Zones

Oracle Solaris kernel zones on x86-based systems make use of hardware-assisted virtualization features like Oracle VM VirtualBox does. However, for kernel zones and Oracle VM VirtualBox to share this hardware resource, they need to cooperate.

By default, due to performance reasons, Oracle VM VirtualBox acquires the hardware-assisted virtualization resource (VT-x/AMD-V) globally on the host machine and uses it until the last Oracle VM VirtualBox VM that requires it is powered off. This prevents other software from using VT-x/AMD-V during the time Oracle VM VirtualBox has taken control of it.

Oracle VM VirtualBox can be instructed to relinquish use of hardware-assisted virtualization features when not executing guest code, thereby allowing kernel zones to make use of them. To do this, shutdown all Oracle VM VirtualBox VMs and execute the following command:

```
$ VBoxManage setproperty hwvirtexclusive off
```

This command needs to be executed only once as the setting is stored as part of the global Oracle VM VirtualBox settings which will continue to persist across host-reboots and Oracle VM VirtualBox upgrades.

Locking Down VirtualBox Manager

Customizing VirtualBox Manager

There are several advanced customization settings for locking down VirtualBox Manager. Locking down means removing some features that the user should not see.

```
VBoxManage setextradata global GUI/Customizations property[,property ...]
```

property is one of the following properties:

noSelector
Do not allow users to start VirtualBox Manager. Trying to do so will show a window containing a proper error message.

noMenuBar
VM windows will not contain a menu bar.

noStatusBar
VM windows will not contain a status bar.

To disable any of these VirtualBox Manager customizations use the following command:

```
$ VBoxManage setextradata global GUI/Customizations
```

VM Selector Customization

The following per-machine VM extradata settings can be used to change the behavior of the VM selector window in respect of certain VMs:

```
$ VBoxManage setextradata VM-name
                    property true
```

property can be any of the following:

GUI/HideDetails
Do not show the VM configuration of a certain VM. The details window will remain just empty if this VM is selected.

GUI/PreventReconfiguration
Do not allow the user to open the **Settings** dialog for a certain VM.

GUI/PreventSnapshotOperations
Prevent snapshot operations for a VM from the GUI, either at runtime or when the VM is powered off.

GUI/HideFromManager
Hide a certain VM in the VM selector window.

GUI/PreventApplicationUpdate
Disable the automatic update check and hide the corresponding menu item.

Note that these settings do not prevent the user from reconfiguring the VM by using the `VBoxManage modifyvm` command.

Configure VM Selector Menu Entries

You can disable certain entries in the global settings page of the VM selector:

```
$ VBoxManage setextradata global GUI/RestrictedGlobalSettingsPages property[,property...]
```

property is one of the following:

General
Do not show the **General** settings pane.

Input
Do not show the **Input** settings pane.

`Update`
Do not show the **Update** settings pane.

`Language`
Do not show the **Language** settings pane.

`Display`
Do not show the **Display** settings pane.

`Network`
Do not show the **Network** settings pane.

`Extensions`
Do not show the **Extensions** settings pane.

`Proxy`
Do not show the **Proxy** settings pane.

This is a global setting. You can specify any combination of properties. To restore the default behavior, use the following command:

```
$ VBoxManage setextradata global GUI/RestrictedGlobalSettingsPages
```

Configure VM Window Menu Entries

You can disable certain menu actions in the VM window:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMenus OPTION[,OPTION...]
```

where `OPTION` is one of the following keywords:

`All`
Do not show any menu in the VM window.

`Application`
Do not show **Application/File** menu in the VM window.

`Machine`
Do not show the **Machine** menu in the VM window.

`View`
Do not show the **View** menu in the VM window.

`Input`
Do not show **Input** menu in the VM window.

`Devices`
Do not show the **Devices** menu in the VM window.

`Help`
Do not show the **Help** menu in the VM window.

`Debug`
Do not show the **Debug** menu in the VM window. The Debug menu is only visible if the GUI was started with special command line parameters or environment variable settings.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use the following command:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMenus
```

You can also disable certain menu actions of certain menus. Use the following command to disable certain actions of the **Application** menu. This is only available on macOS hosts.

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeApplicationMenuActions
OPTION[,OPTION...]
```

where `OPTION` is one of the following keywords:

`All`
Do not show any menu item in this menu.

`About`
Do not show the **About** menu item in this menu.

`Preferences`
Do not show the **Preferences** menu item in this menu.

`NetworkAccessManager`
Do not show the **Network Operations Manager** menu item in this menu.

`ResetWarnings`
Do not show the **Reset All Warnings** menu item in this menu.

`Close`
Do not show the **Close** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use the following command:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMenus
```

Use the following command to disable certain actions of the **Machine** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMachineMenuActions
OPTION[,OPTION...]
```

where `OPTION` is one of the following keywords:

`All`
Do not show any menu item in this menu.

`SettingsDialog`
Do not show the **Settings** menu item in this menu.

`TakeSnapshot`
Do not show the **Take Snapshot...** menu item in this menu.

`InformationDialog`
Do not show the **Session Information...** menu item in this menu.

`FileManagerDialog`
Do not show the **File Manager...** menu item in this menu.

`Pause`
Do not show the **Pause** menu item in this menu.

`Reset`
Do not show the **Reset** menu item in this menu.

`Shutdown`
Do not show the **ACPI Shutdown** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeMachineMenuActions
```

Use the following command to disable certain actions of the **View** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeViewMenuActions
OPTION[,OPTION...]
```

where `OPTION` is one of the following keywords:

`All`
Do not show any menu item in this menu.

`Fullscreen`
Do not show the **Full-screen Mode** menu item in this menu.

`Seamless`
Do not show the **Seamless Mode** menu item in this menu.

`Scale`
Do not show the **Scaled Mode** menu item in this menu.

`GuestAutoresize`
Do not show the **Auto-resize Guest Display** menu item in this menu.

`AdjustWindow`
Do not show the **Adjust Window Size** menu item in this menu.

`TakeScreenshot`
Do not show the **Take Screenshot...** menu item in this menu.

`Recording`
Do not show the **Recording** menu item in this menu.

`VRDEServer`
Do not show the **Remote Display** menu item in this menu.

`MenuBar`
Do not show the **Menu Bar** menu item in this menu.

`MenuBarSettings`
Do not show the **Menu Bar Settings...** menu item in this menu.

`StatusBar`
Do not show the **Status Bar** menu item in this menu.

`StatusbarSettings`
Do not show the **Statusbar Settings...** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeViewMenuActions
```

Use the following command to disable certain actions of the **Input** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeInputMenuActions
OPTION[,OPTION...]
```

where `OPTION` is one of the following keywords:

`All`
Do not show any menu item in this menu.

`Keyboard`
Do not show the **Keyboard** menu item in this menu.

`KeyboardSettings`
Do not show the **Keyboard Settings...** menu item in this menu.

`SoftKeyboard`
Do not show the **Soft Keyboard...** menu item in this menu.

`TypeCAD`
Do not show the **Insert Ctrl-Alt-Del** menu item in this menu.

`TypeCABS`
Do not show the **Insert Ctrl-Alt-Backspace** menu item in this menu.

`TypeCtrlBreak`
Do not show the **Insert Ctrl-Break** menu item in this menu.

`TypeInsert`
Do not show the **Insert Insert** menu item in this menu.

`TypePrintScreen`
Do not show the **Insert Print Screen** menu item in this menu.

`TypeAltPrintScreen`
Do not show the **Insert Alt Print Screen** menu item in this menu.

`TypeHostKeyCombo`
Do not show the **Insert Host Key Combo** menu item in this menu.

`MouseIntegration`
Do not show the **MouseIntegration** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeInputMenuActions
```

Use the following command to disable certain actions of the **Devices** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeDevicesMenuActions
OPTION[,OPTION...]
```

where `OPTION` is one of the following keywords to disable actions in the **Devices** menu:

`All`
Do not show any menu item in this menu.

`HardDrives`
Do not show the **Hard Disks** menu item in this menu.

`OpticalDevices`
Do not show the **Optical Devices** menu item in this menu.

`FloppyDevices`
Do not show the **Floppy Drives** menu item in this menu.

`Audio`
Do not show the **Audio** menu item in this menu.

`Network`
Do not show the **Network** menu item in this menu.

`NetworkSettings`
Do not show the **Network Settings** menu item in this menu.

`USBDevices`
Do not show the **USB** menu item in this menu.

`WebCams`
Do not show the **WebCams** menu item in this menu.

`SharedFolders`
Do not show the **Shared Folders** menu item in this menu.

`SharedFoldersSettings`
Do not show the **Shared Folders Settings...** menu item in this menu.

`SharedClipboard`
Do not show the **Shared Clipboard** menu item in this menu.

`DragAndDrop`
Do not show the **Drag and Drop** menu item in this menu.

`InstallGuestTools`
Do not show the **Insert Guest Additions CD image...** menu item in this menu.

This is a per-VM or global or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeDevicesMenuActions
```

Use the following command to disable certain actions of the **Debug** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeDebuggerMenuActions
OPTION[,OPTION...]
```

where `OPTION` is one of the following keywords to disable actions in the *Debug* menu, which is normally completely disabled:

`All`
Do not show any menu item in this menu.

`Statistics`
Do not show the **Statistics...** menu item in this menu.

`CommandLine`
Do not show the **Command Line...** menu item in this menu.

`Logging`
Do not show the **Logging...** menu item in this menu.

`LogDialog`
Do not show the **Show Log...** menu item in this menu.

`GuestControlConsole`
Do not show the **Guest Control Terminal...** menu item in this menu.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeDebuggerMenuActions
```

Use the following command to disable certain actions of the **View** menu:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeHelpMenuActions
OPTION[,OPTION...]
```

where `OPTION` is one of the following keywords to disable actions in the **Help** menu, which is normally completely disabled:

`All`
Do not show any menu item in this menu.

`Contents`
Do not show the **Contents...** menu item in this menu.

`WebSite`
Do not show the **VirtualBox Web Site...** menu item in this menu.

`BugTracker`
Do not show the **VirtualBox Bug Tracker...** menu item in this menu.

`Forums`
Do not show the **VirtualBox Forums...** menu item in this menu.

`Oracle`
Do not show the **Oracle Web Site...** menu item in this menu.

`About`
Do not show the **About VirtualBox...** menu item in this menu. Only for non-macOS hosts.

This is a per-VM or global setting. Any combination of the above is allowed. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedRuntimeHelpMenuActions
```

Configure VM Window Status Bar Entries

You can disable certain status bar items:

```
VBoxManage setextradata "VM name"|global GUI/RestrictedStatusBarIndicators
OPTION[,OPTION...]
```

where `OPTION` is one of the following keywords:

HardDisks
Do not show the hard disk icon in the VM window status bar. By default the hard disk icon is only shown if the VM configuration contains one or more hard disks.

OpticalDisks
Do not show the CD icon in the VM window status bar. By default the CD icon is only shown if the VM configuration contains one or more CD drives.

FloppyDisks
Do not show the floppy icon in the VM window status bar. By default the floppy icon is only shown if the VM configuration contains one or more floppy drives.

Network
Do not show the network icon in the VM window status bar. By default the network icon is only shown if the VM configuration contains one or more active network adapters.

USB
Do not show the USB icon in the status bar.

SharedFolders
Do not show the shared folders icon in the status bar.

Capture
Do not show the capture icon in the status bar.

Features
Do not show the CPU features icon in the status bar.

Mouse
Do not show the mouse icon in the status bar.

Keyboard
Do not show the keyboard icon in the status bar.

This is a per-VM or global setting. Any combination of the above is allowed. If all options are specified, no icons are displayed in the status bar of the VM window. To restore the default behavior, use

```
VBoxManage setextradata "VM name"|global GUI/RestrictedStatusBarIndicators
```

Configure VM Window Visual Modes

You can disable certain VM visual modes:

```
$ VBoxManage setextradata VM-name GUI/RestrictedVisualStates property[,property...]
```

property is one of the following:

Fullscreen
Do not allow to switch the VM into full screen mode.

Seamless
Do not allow to switch the VM into seamless mode.

Scale
Do not allow to switch the VM into scale mode.

This is a per-VM setting. You can specify any combination of properties. To restore the default behavior, use the following command:

```
$ VBoxManage setextradata VM-name GUI/RestrictedVisualStates
```

Host Key Customization

To disable all Host key combinations, open the preferences and change the Host key to None. This might be useful when using Oracle VM VirtualBox in a kiosk mode.

To redefine or disable certain Host key actions, use the following command:

```
$ VBoxManage setextradata global GUI/Input/MachineShortcuts "FullscreenMode=F,...."
```

The following table shows the possible Host key actions, together with their default Host key shortcut. Setting an action to None will disable that Host key action.

Table 9-1 Host Key Customization

Action	Default Key	Action
TakeSnapshot	T	Take a snapshot
TakeScreenshot	E	Take a screenshot
MouseIntegration	I	Toggle mouse integration
TypeCAD	Del	Inject Ctrl+Alt+Del
TypeCABS	Backspace	Inject Ctrl+Alt+Backspace
Pause	P	Pause the VM
Reset	R	Hard reset the guest
SaveState		Save the VM state and terminate the VM
Shutdown	H	Press the virtual ACPI power button
PowerOff		Power off the VM without saving the state
Close	Q	Show the Close VM dialog
FullscreenMode	F	Switch the VM into full screen mode
SeamlessMode	L	Switch the VM into seamless mode
ScaleMode	C	Switch the VM into scaled mode
GuestAutoResize	G	Automatically resize the guest window
WindowAdjust	A	Immediately resize the guest window
PopupMenu	Home	Show the popup menu in full screen mode and seamless mode
SettingsDialog	S	Open the VM Settings dialog
InformationDialog	N	Show the VM Session Information window
NetworkAdaptersDialog		Show the VM Network Adapters dialog

Table 9-1 (Cont.) Host Key Customization

Action	Default Key	Action
SharedFoldersDialog		Show the VM Shared Folders dialog
InstallGuestAdditions	D	Mount the ISO containing the Guest Additions

To disable full screen mode and seamless mode, use the following command:

```
$ VBoxManage setextradata global GUI/Input/MachineShortcuts
"FullscreenMode=None,SeamlessMode=None"
```

Action when Terminating the VM

You can disallow certain actions when terminating a VM. To disallow specific actions, use the following command:

```
$ VBoxManage setextradata VM-name GUI/RestrictedCloseActions property[,property...]
```

property is one of the following:

SaveState
Do not allow the user to save the VM state when terminating the VM.

Shutdown
Do not allow the user to shutdown the VM by sending the ACPI power-off event to the guest.

PowerOff
Do not allow the user to power off the VM.

PowerOffRestoringSnapshot
Do not allow the user to return to the last snapshot when powering off the VM.

Detach
Do not allow the user to detach from the VM process if the VM was started in separate mode.

This is a per-VM setting. You can specify any combination of properties. If all properties are specified, the VM cannot be shut down.

Default Action when Terminating the VM

You can define a specific action for terminating a VM. In contrast to the setting decribed in the previous section, this setting allows only one action when the user terminates the VM. No exit menu is shown. Use the following command:

```
$ VBoxManage setextradata VM-name GUI/DefaultCloseAction action
```

action is one of the following:

SaveState
Save the VM state before terminating the VM process.

Shutdown
The VM is shut down by sending the ACPI power-off event to the guest.

PowerOff
The VM is powered off.

PowerOffRestoringSnapshot
The VM is powered off and the saved state returns to the last snapshot.

Detach
Terminate the frontend but leave the VM process running.

This is a per-VM setting. You can specify any combination of properties. If all properties are specified, the VM cannot be shut down.

Action for Handling a Guru Meditation

A VM runs into a Guru Meditation if there is a problem which cannot be fixed by other means than terminating the process. The default is to show a message window which instructs the user to open a bug report.

This behavior can be configured as follows:

```
$ VBoxManage setextradata VM-name GUI/GuruMeditationHandler mode
```

mode is one of the following:

Default
A message window is shown. After the user confirmed, the VM is terminated.

PowerOff
The VM is immediately powered-off without showing any message window. The VM logfile will show information about what happened.

Ignore
The VM is left in stuck mode. Execution is stopped but no message window is shown. The VM has to be powered off manually.

This is a per-VM setting.

Configuring Automatic Mouse Capturing

By default, the mouse is captured if the user clicks on the guest window and the guest expects relative mouse coordinates at this time. This happens if the pointing device is configured as PS/2 mouse and the guest has not yet started the Oracle VM VirtualBox Guest Additions. For instance, the guest is booting or the Guest Additions are not installed, or if the pointing device is configured as a USB tablet but the guest has no USB driver loaded yet. Once the Guest Additions become active or the USB guest driver is started, the mouse capture is automatically released.

The default behavior is sometimes not desired. Therefore it can be configured as follows:

```
VBoxManage setextradata VM-name GUI/MouseCapturePolicy mode
```

mode is one of the following:

`Default`
The default behavior as described above.

`HostComboOnly`
The mouse is only captured if the Host Key is toggled.

`Disabled`
The mouse is never captured, also not by toggling the Host Key

This is a per-VM setting.

Requesting Legacy Full-Screen Mode

Oracle VM VirtualBox uses special window manager facilities to switch a multi-screen machine to full-screen on a multi-monitor host system. However, not all window managers provide these facilities correctly. Oracle VM VirtualBox can be configured to use a legacy method of switching to full-screen mode instead, by using the command:

```
VBoxManage setextradata global GUI/Fullscreen/LegacyMode true
```

You can go back to the default method by using the following command:

```
VBoxManage setextradata global GUI/Fullscreen/LegacyMode
```

This is a global setting.

Removing Certain Modes of Networking From the GUI

It is possible to remove networking modes from Oracle VM VirtualBox GUI. To do this, use the following command:

```
VBoxManage setextradata global GUI/RestrictedNetworkAttachmentTypes
property[,property...]
```

property is one of the following:

`NAT`
Remove the **NAT** option from the GUI.

`NATNetwork`
Remove the **NAT network** option from the GUI.

`BridgedAdapter`
Remove the **Bridged networking** option from the GUI.

`InternalNetwork`
Remove the **Internal networking** option from the GUI.

`HostOnlyAdapter`
Remove the **Host Only networking** option from the GUI.

`GenericDriver`
Remove the **Generic networking** option from the GUI.

This is a global setting. You can specify any combination of properties. To restore the default behavior, use the following command:

```
VBoxManage setextradata global GUI/RestrictedNetworkAttachmentTypes
```

Starting the Oracle VM VirtualBox Web Service Automatically

The Oracle VM VirtualBox web service, `vboxwebsrv`, is used for controlling Oracle VM VirtualBox remotely. It is documented in detail in the Oracle VM VirtualBox Software Development Kit (SDK). See Oracle VM VirtualBox Programming Interfaces. Web service start scripts are available for supported host operating systems. The following sections describe how to use the scripts. The Oracle VM VirtualBox web service is never started automatically as a result of a standard installation.

Linux: Starting the Web Service With init

On Linux, the web service can be automatically started during host boot by adding appropriate parameters to the file `/etc/default/virtualbox`. There is one mandatory parameter, `VBOXWEB_USER`, which must be set to the user which will later start the VMs. The parameters in the following table all start with the `VBOXWEB_` prefix string. For example: `VBOXWEB_HOST` and `VBOXWEB_PORT`.

Table 9-2 Web Service Configuration Parameters

Parameter	Description	Default
`USER`	The user which the web service runs as	
`HOST`	The host to bind the web service to	localhost
`PORT`	The port to bind the web service to	18083
`SSL_KEYFILE`	Server key and certificate file, in PEM format	
`SSL_PASSWORDFILE`	File name for password to server key	
`SSL_CACERT`	CA certificate file, in PEM format	
`SSL_CAPATH`	CA certificate path	
`SSL_DHFILE`	DH file name or DH key length in bits	
`SSL_RANDFILE`	File containing seed for random number generator	
`TIMEOUT`	Session timeout in seconds, 0 disables timeouts	300
`CHECK_INTERVAL`	Frequency of timeout checks in seconds	5
`THREADS`	Maximum number of worker threads to run in parallel	100
`KEEPALIVE`	Maximum number of requests before a socket will be closed	100
`ROTATE`	Number of log files, 0 disables log rotation	10
`LOGSIZE`	Maximum log file size to trigger rotation, in bytes	1MB

Table 9-2 (Cont.) Web Service Configuration Parameters

Parameter	Description	Default
LOGINTERVAL	Maximum time interval to trigger log rotation, in seconds	1 day

Setting the parameter `SSL_KEYFILE` enables the SSL/TLS support. Using encryption is strongly encouraged, as otherwise everything, including passwords, is transferred in clear text.

Oracle Solaris: Starting the Web Service With SMF

On Oracle Solaris hosts, the Oracle VM VirtualBox web service daemon is integrated into the SMF framework. You can change the parameters, but do not have to if the defaults below already match your needs:

```
svccfg -s svc:/application/virtualbox/webservice:default setprop config/host=localhost
svccfg -s svc:/application/virtualbox/webservice:default setprop config/port=18083
svccfg -s svc:/application/virtualbox/webservice:default setprop config/user=root
```

The table in Linux: Starting the Web Service With init showing the parameter names and defaults also applies for Oracle Solaris. The parameter names must be changed to lowercase and a prefix of `config/` has to be added. For example: `config/user` or `config/ssl_keyfile`. If you make any change, do not forget to run the following command to put the changes into effect immediately:

```
svcadm refresh svc:/application/virtualbox/webservice:default
```

If you forget the above command then the previous settings are used when enabling the service. Check the current property settings as follows:

```
svcprop -p config svc:/application/virtualbox/webservice:default
```

When everything is configured correctly you can start the Oracle VM VirtualBox web service with the following command:

```
svcadm enable svc:/application/virtualbox/webservice:default
```

For more information about SMF, please refer to the Oracle Solaris documentation.

macOS: Starting the Web Service With launchd

On macOS, launchd is used to start the Oracle VM VirtualBox webservice. An example configuration file can be found in `$HOME/Library/LaunchAgents/org.virtualbox.vboxwebsrv.plist`. It can be enabled by changing the `Disabled` key from `true` to `false`. To manually start the service use the following command:

```
launchctl load ~/Library/LaunchAgents/org.virtualbox.vboxwebsrv.plist
```

For additional information on how launchd services could be configured see:

https://developer.apple.com/library/mac/documentation/MacOSX/Conceptual/BPSystemStartup/Chapters/CreatingLaunchdJobs.html.

Oracle VM VirtualBox Watchdog

The memory ballooning service, formerly known as `VBoxBalloonCtrl`, was renamed to VBoxWatchdog. This service now incorporates the following host services that are meant to be run in a server environment:

- **Memory ballooning control.** This service automatically takes care of a VM's configured memory balloon. See Memory Ballooning. This service is useful for server environments where VMs may dynamically require more or less memory during runtime.

  The service periodically checks a VM's current memory balloon and its free guest RAM and automatically adjusts the current memory balloon by inflating or deflating it accordingly. This handling only applies to running VMs having recent Guest Additions installed.

- **Host isolation detection.** This service provides a way to detect whether the host cannot reach the specific Oracle VM VirtualBox server instance anymore and take appropriate actions, such as shutting down, saving the current state or even powering down certain VMs.

All configuration values can be either specified using the command line or global extradata, whereas command line values always have a higher priority when set. Some of the configuration values also be specified on a per-VM basis. So the overall lookup order is: command line, per-VM basis extradata if available, global extradata.

Memory Ballooning Control

The memory ballooning control inflates and deflates the memory balloon of VMs based on the VMs free memory and the desired maximum balloon size.

To set up the memory ballooning control the maximum ballooning size a VM can reach needs to be set. This can be specified using the command line, as follows:

```
--balloon-max <Size in MB>
```

Using a per-VM basis extradata value, as follows:

```
VBoxManage setextradata <VM-Name> VBoxInternal2/Watchdog/BalloonCtrl/BalloonSizeMax
<Size in MB>
```

Using a global extradata value, as follows:

```
VBoxManage setextradata global VBoxInternal2/Watchdog/BalloonCtrl/BalloonSizeMax <Size
in MB>
```

> **Note:**
>
> If no maximum ballooning size is specified by at least one of the parameters above, no ballooning will be performed at all.

Setting the ballooning increment in MB can be either done using command line, as follows:

```
--balloon-inc <Size in MB>
```

Using a global extradata value, as follows:

```
VBoxManage setextradata global VBoxInternal2/Watchdog/BalloonCtrl/BalloonIncrementMB
<Size in MB>
```

The default ballooning increment is 256 MB if not specified.

The same options apply for a ballooning decrement. Using the command line, as follows:

```
--balloon-dec <Size in MB>
```

Using a global extradata value, as follows:

```
VBoxManage setextradata global VBoxInternal2/Watchdog/BalloonCtrl/BalloonDecrementMB
<Size in MB>
```

The default ballooning decrement is 128 MB if not specified.

The lower limit in MB for a balloon can be defined using the command line, as follows:

```
--balloon-lower-limit <Size in MB>
```

Using a global extradata value, as follows:

```
VBoxManage setextradata global VBoxInternal2/Watchdog/BalloonCtrl/BalloonLowerLimitMB
<Size in MB>
```

The default lower limit is 128 MB if not specified.

Host Isolation Detection

To detect whether a host is being isolated, that is, the host cannot reach the Oracle VM VirtualBox server instance anymore, the host needs to set an alternating value to a global extradata value within a time period. If this value is not set within that time period a timeout occurred and the so-called host isolation response will be performed to the VMs handled. Which VMs are handled can be controlled by defining VM groups and assigning VMs to those groups. By default no groups are set, meaning that all VMs on the server will be handled when no host response is received within 30 seconds.

Set the groups handled by the host isolation detection using the following command line:

```
--apimon-groups=<string[,stringN]>
```

Using a global extradata value, as follows:

```
VBoxManage setextradata global VBoxInternal2/Watchdog/APIMonitor/Groups
<string[,stringN]>
```

Set the host isolation timeout using the following command line:

```
--apimon-isln-timeout=<ms>
```

Using a global extradata value, as follows:

```
VBoxManage setextradata global VBoxInternal2/Watchdog/APIMonitor/IsolationTimeoutMS <ms>
```

Set the actual host isolation response using the following command line:

```
--apimon-isln-response=<cmd>
```

Using a global extradata value, as follows:

```
VBoxManage setextradata global VBoxInternal2/Watchdog/APIMonitor/IsolationResponse <cmd>
```

The following response commands are available:

- `none`. This has no effect.
- `pause`. Pauses the execution of a VM.
- `poweroff`. Shuts down the VM by pressing the virtual power button. The VM will not have the chance of saving any data or veto the shutdown process.
- `save`. Saves the current machine state and powers off the VM afterwards. If saving the machine state fails the VM will be paused.
- `shutdown`. Shuts down the VM in a gentle way by sending an `ACPI` shutdown event to the VM's operating system. The OS then has the chance of doing a clean shutdown.

More Information

For more advanced options and parameters like verbose logging check the built-in command line help accessible with `--help`.

Linux: Starting the Watchdog Service With init

On Linux, the watchdog service can be automatically started during host boot by adding appropriate parameters to the file `/etc/default/virtualbox`. There is one mandatory parameter, `VBOXWATCHDOG_USER`, which must be set to the user which will later start the VMs. For backward compatibility you can also specify `VBOXBALLOONCTRL_USER`.

The parameters in the following table all start with the `VBOXWATCHDOG_` prefix string. For example: `VBOXWATCHDOG_BALLOON_INTERVAL` and `VBOXWATCHDOG_LOGSIZE`. Legacy parameters such as `VBOXBALLOONCTRL_INTERVAL` can still be used.

Table 9-3 Oracle VM VirtualBox Watchdog Configuration Parameters

Parameter	Description	Default
`USER`	The user which the watchdog service runs as	
`ROTATE`	Number of log files, 0 disables log rotation	10
`LOGSIZE`	Maximum log file size to trigger rotation, in bytes	1MB
`LOGINTERVAL`	Maximum time interval to trigger log rotation, in seconds	1 day
`BALLOON_INTERVAL`	Interval for checking the balloon size, in milliseconds	30000
`BALLOON_INCREMENT`	Balloon size increment, in megabytes	256
`BALLOON_DECREMENT`	Balloon size decrement, in megabytes	128
`BALLOON_LOWERLIMIT`	Balloon size lower limit, in megabytes	64
`BALLOON_SAFETYMARGIN`	Free memory required for decreasing the balloon size, in megabytes	1024

Oracle Solaris: Starting the Watchdog Service With SMF

On Oracle Solaris hosts, the Oracle VM VirtualBox watchdog service daemon is integrated into the SMF framework. You can change the parameters, but do not have to if the defaults already match your needs:

```
svccfg -s svc:/application/virtualbox/balloonctrl:default setprop \
  config/balloon_interval=10000
svccfg -s svc:/application/virtualbox/balloonctrl:default setprop \
config/balloon_safetymargin=134217728
```

Table 9-3 also applies for Oracle Solaris. The parameter names must be changed to lowercase and a prefix of `config/` has to be added. For example: `config/user` or `config/balloon_safetymargin`. If you made any change, do not forget to run the following command to put the changes into effect immediately:

```
svcadm refresh svc:/application/virtualbox/balloonctrl:default
```

If you forget the above command then the previous settings will be used when enabling the service. Check the current property settings with the following command:

```
svcprop -p config svc:/application/virtualbox/balloonctrl:default
```

When everything is configured correctly you can start the Oracle VM VirtualBox watchdog service with the following command:

```
svcadm enable svc:/application/virtualbox/balloonctrl:default
```

For more information about SMF, please refer to the Oracle Solaris documentation.

Other Extension Packs

Another extension pack called VNC is available. This extension pack is open source and replaces the previous integration of the VNC remote access protocol. This is experimental code, and is initially available in the Oracle VM VirtualBox source code package only. It is to a large portion code contributed by users, and is not supported in any way by Oracle.

The keyboard handling is severely limited, and only the US keyboard layout works. Other keyboard layouts will have at least some keys which produce the wrong results, often with quite surprising effects, and for layouts which have significant differences to the US keyboard layout it is most likely unusable.

It is possible to install both the Oracle VM VirtualBox Extension Pack and VNC, but only one VRDE module can be active at any time. The following command switches to the VNC VRDE module in VNC:

```
VBoxManage setproperty vrdeextpack VNC
```

Configuring the remote access works very similarly to VRDP, see Remote Display (VRDP Support), with some limitations. VNC does not support specifying several port numbers, and the authentication is done differently. VNC can only deal with password authentication, and there is no option to use password hashes. This leaves no other choice than having a clear-text password in the VM configuration, which can be set with the following command:

```
VBoxManage modifyvm VM-name --vrde-property VNCPassword=secret
```

The user is responsible for keeping this password secret, and it should be removed when a VM configuration is passed to another person, for whatever purpose. Some VNC servers claim to

have encrypted passwords in the configuration. This is not true encryption, it is only concealing the passwords, which is only as secure as using clear-text passwords.

The following command switches back to VRDP, if installed:

```
VBoxManage setproperty vrdeextpack "Oracle VM VirtualBox Extension Pack"
```

Starting Virtual Machines During System Boot

You can start VMs automatically during system boot on Linux, Oracle Solaris, and macOS platforms for all users.

Linux: Starting the Autostart Service With init

On Linux, the autostart service is activated by setting two variables in `/etc/default/virtualbox`. The first one is `VBOXAUTOSTART_DB` which contains an absolute path to the autostart database directory. The directory should have write access for every user who should be able to start virtual machines automatically. Furthermore the directory should have the sticky bit set. The second variable is `VBOXAUTOSTART_CONFIG` which points the service to the autostart configuration file which is used during boot to determine whether to allow individual users to start a VM automatically and configure startup delays. The configuration file can be placed in `/etc/vbox` and contains several options. One is `default_policy` which controls whether the autostart service allows or denies to start a VM for users which are not in the exception list. The exception list starts with `exception_list` and contains a comma separated list with usernames. Furthermore a separate startup delay can be configured for every user to avoid overloading the host. A sample configuration is given below:

```
# Default policy is to deny starting a VM, the other option is "allow".
default_policy = deny

# Bob is allowed to start virtual machines but starting them
# will be delayed for 10 seconds
bob = {
    allow = true
    startup_delay = 10
}

# Alice is not allowed to start virtual machines, useful to exclude certain users
# if the default policy is set to allow.
alice = {
    allow = false
}
```

Any user who wants to enable autostart for individual machines must set the path to the autostart database directory with the following command:

```
VBoxManage setproperty autostartdbpath autostart-directory
```

Oracle Solaris: Starting the Autostart Service With SMF

On Oracle Solaris hosts, the Oracle VM VirtualBox autostart daemon is integrated into the SMF framework. To enable it you must point the service to an existing configuration file which has the same format as on Linux, see Linux: Starting the Autostart Service With init. For example:

```
# svccfg -s svc:/application/virtualbox/autostart:default setprop \
  config/config=/etc/vbox/autostart.cfg
```

When everything is configured correctly you can start the Oracle VM VirtualBox autostart service with the following command:

```
# svcadm enable svc:/application/virtualbox/autostart:default
```

For more information about SMF, see the Oracle Solaris documentation.

macOS: Starting the Autostart Service With launchd

On macOS, launchd is used to start the Oracle VM VirtualBox autostart service. An example configuration file can be found in `/Applications/VirtualBox.app/Contents/MacOS/org.virtualbox.vboxautostart.plist`. To enable the service copy the file to `/Library/LaunchDaemons` and change the `Disabled` key from `true` to `false`. Furthermore replace the second parameter to an existing configuration file which has the same format as on Linux, see Linux: Starting the Autostart Service With init.

To manually start the service use the following command:

```
# launchctl load /Library/LaunchDaemons/org.virtualbox.vboxautostart.plist
```

For additional information on how launchd services can be configured see:

http://developer.apple.com/mac/library/documentation/MacOSX/Conceptual/BPSystemStartup/BPSystemStartup.html.

Windows: Starting the Autostart Service

On Windows, autostart functionality consist of two components. The first component is a configuration file where the administrator can both set a delayed start for the VMs and temporarily disable autostarting for a particular user. The configuration file should be located in a folder accessible by all required users but it should have permissions allowing only reading by everyone but administrators. The configuration file contains several options. The `default_policy` controls whether the autostart service allows or denies starting of a VM for users that are not in the exception list. The exception list starts with `exception_list` and contains a comma separated list with usernames. Furthermore, a separate startup delay can be configured for every user to avoid overloading the host. A sample configuration is given below:

```
# Default policy is to deny starting a VM, the other option is "allow".
default_policy = deny

# Bob is allowed to start virtual machines but starting them
# will be delayed for 10 seconds
bob = {
    allow = true
    startup_delay = 10
}

# Alice is not allowed to start virtual machines, useful to exclude certain users
# if the default policy is set to allow.
alice = {
    allow = false
}
```

The user name can be specified using the following forms: "user", "domain\user", ".\user" and "user@domain". An administrator must add the `VBOXAUTOSTART_CONFIG` environment variable into system variables containing the path to the configuration file described above. The environment variable tells the autostart services which configuration file is used.

The second component of autostart functionality is a Windows service. Every instance of this works on behalf of a particular user using their credentials.

To enable autostarting for a particular user, a member of the administrators group must run the following command:

```
VBoxAutostartSvc install --user=user [--password-file=password_file]
```

The password file should contain the password followed by a line break. The rest of the file is ignored. The user will be asked for a password if the password file is not specified.

To disable autostarting for particular user, a member of the administrators group must run the following command:

```
VBoxAutostartSvc delete --user=user
```

If a user has changed their password then a member of the administrators group must either reinstall the service or change the service credentials using Windows Service Manager. Due to Windows security policies, the autostart service cannot be installed for users with empty passwords.

Finally, the user should define which VMs should be started at boot. The user should run the following command for every VM they wish to start at boot:

```
VBoxManage modifyvm VM name or UUID --autostart-enabled on
```

The user can remove a particular VM from the VMs starting at boot by running the following command:

```
VBoxManage modifyvm VM name or UUID --autostart-enabled off
```

> **Note:**
>
> On Windows hosts, starting VMs via the autostart service might cause some issues, as the virtual machines are starting within the same session as VBoxSVC. For more information see VBoxSVC running in Windows Session 0.

Encryption of VMs

Oracle VM VirtualBox enables you to transparently encrypt the VM data stored in the configuration file, saved state, and EFI boot data for the guest.

Oracle VM VirtualBox uses the AES algorithm in various modes. The selected mode depends on the encrypting component of the VM. Oracle VM VirtualBox supports 128-bit or 256-bit data encryption keys (DEK). The DEK is stored encrypted in the VM configuration file and is decrypted during VM startup.

Since the DEK is stored as part of the VM configuration file, it is important that the file is kept safe. Losing the DEK means that the data stored in the VM is lost irrecoverably. Having complete and up to date backups of all data related to the VM is the responsibility of the user.

The VM, even if it is encrypted, may contain media encrypted with different passwords. To deal with this, the password for the VM has a password identifier, in the same way as passwords for media. The password ID is an arbitrary string which uniquely identifies the password in the VM and its media. You can use the same password and ID for both the VM and its media.

Limitations of VM Encryption

There are some limitations the user needs to be aware of when using this feature:

- Exporting appliances containing an encrypted VM is not possible, because the OVF specification does not support this. The VM is therefore decrypted during export.
- The DEK is kept in memory while the VM is running to be able to encrypt and decrypt VM data. While this should be obvious the user needs to be aware of this because an attacker might be able to extract the key on a compromised host and decrypt the data.
- When encrypting or decrypting the VM, the password is passed in clear text using the Oracle VM VirtualBox API. This needs to be kept in mind, especially when using third party API clients which make use of the web service where the password might be transmitted over the network. The use of HTTPS is mandatory in such a case.

Encrypting a VM

Encrypting a VM can be done either using VirtualBox Manager or the `VBoxManage`. To encrypt an unencrypted VM with `VBoxManage`, use:

```
VBoxManage encryptvm uuid|vmname setencryption --new-password filename|- \
--cipher cipher-ID --new-password-id ID
```

To supply the encryption password, point `VBoxManage` to the file where the password is stored or specify `-` to let `VBoxManage` prompt for the password on the command line.

The cipher parameter specifies the cipher to use for encryption and can be either `AES-128` or `AES-256`. The appropriate mode of operation, such as GCM, CTR, or XTS will be selected by the VM depending on the encrypting component. The specified password identifier can be freely chosen by the user and is used for correct identification when supplying multiple passwords for the VM.

Opening the Encrypted VM

When Oracle VM VirtualBox has just started up the encrypted VM cannot be opened and it stays inaccessible. Also, the encrypted VM stays inaccessible if it was just registered without a password or the password is incorrect. The user needs to provide the password using VirtualBox Manager or with the following `VBoxManage` command:

```
VBoxManage encryptvm uuid|vmname addpassword --password filename|- --password-id ID
```

To supply the encryption password point `VBoxManage` to the file where the password is stored or specify `-` to let `VBoxManage` prompt for the password on the command line.

If *ID* is the same as the password identifier supplied when encrypting the VM it updates the accessibility state.

To remove the entered password from the VM memory, use `VBoxManage` as follows:

```
VBoxManage encryptvm uuid|vmname removepassword ID
```

If *ID* is the same as the password identifier supplied when encrypting the VM it updates the accessibility state.

> **Note:**
>
> If a machine becomes inaccessible all passwords are purged. You have to add required passwords again, using the `VBoxManage encryptvm` *vmname* `addpassword` command. See Opening the Encrypted VM.

Decrypting Encrypted VMs

In some circumstances it might be required to decrypt previously encrypted VMs. This can be done in VirtualBox Manager or using `VBoxManage` with the following command:

```
VBoxManage encryptvm uuid|vmname setencryption --old-password file|-
```

The only required parameter is the password the VM was encrypted with. The options are the same as for encrypting VMs.

Oracle VM VirtualBox Expert Storage Management

In case the snapshot model of Oracle VM VirtualBox is not sufficient it is possible to enable a special mode which makes it possible to reconfigure storage attachments while the VM is paused. The user has to make sure that the disk data stays consistent to the guest because unlike with hotplugging the guest is not informed about detached or newly attached media.

The expert storage management mode can be enabled per VM executing:

```
$ VBoxManage setextradata VM-name "VBoxInternal2/SilentReconfigureWhilePaused" 1
```

You can reconfigure storage attachments later while the VM is paused by using the `VBoxManage storageattach` command.

Handling of Host Power Management Events

Some host power management events are handled by Oracle VM VirtualBox. The actual behavior depends on the platform:

- **Host Suspends.** This event is generated when the host is about to suspend, that is, the host saves the state to some non-volatile storage and powers off.

  This event is currently only handled on Windows hosts and Mac OS X hosts. When this event is generated, Oracle VM VirtualBox will pause all running VMs.

- **Host Resumes.** This event is generated when the host woke up from the suspended state.

  This event is currently only handled on Windows hosts and Mac OS X hosts. When this event is generated, Oracle VM VirtualBox will resume all VMs which are where paused before.

- **Battery Low.** The battery level reached a critical level, usually less than 5 percent charged.

  This event is currently only handled on Windows hosts and Mac OS X hosts. When this event is generated, Oracle VM VirtualBox will save the state and terminate all VMs in preparation of a potential host powerdown.

  The behavior can be configured. By executing the following command, no VM is saved:

  ```
  $ VBoxManage setextradata global "VBoxInternal2/SavestateOnBatteryLow" 0
  ```

This is a global setting as well as a per-VM setting. The per-VM value has higher precedence than the global value. The following command will save the state of all VMs but will not save the state of VM "foo":

```
$ VBoxManage setextradata global "VBoxInternal2/SavestateOnBatteryLow" 1
$ VBoxManage setextradata "foo" "VBoxInternal2/SavestateOnBatteryLow" 0
```

The first line is actually not required as by default the savestate action is performed.

Passing Through SSE4.1/SSE4.2 Instructions

To provide SSE 4.1/SSE 4.2 support to guests, the host CPU has to implement these instruction sets. The instruction sets are exposed to guests by default, but it is possible to disable the instructions for certain guests by using the following commands:

```
$ VBoxManage setextradata VM-name \
VBoxInternal/CPUM/IsaExts/SSE4.1 0
$ VBoxManage setextradata VM-name \
VBoxInternal/CPUM/IsaExts/SSE4.2 0
```

These are per-VM settings which are enabled by default.

Support for Keyboard Indicator Synchronization

This feature makes the host keyboard indicators (LEDs) match those of the VM's emulated keyboard when the machine window is active. It is currently implemented for macOS and Windows hosts. This feature is enabled by default on supported host OSes. You can disable this feature by running the following command:

```
$ VBoxManage setextradata VM-name GUI/HidLedsSync 0
```

This is a per-VM setting that is enabled by default.

Capturing USB Traffic for Selected Devices

You can capture USB traffic for single USB devices or on the root hub level, which captures the traffic of all USB devices attached to the root hub. Oracle VM VirtualBox stores the traffic in a format which is compatible with Wireshark. To capture the traffic of a specific USB device it must be attached to the VM with `VBoxManage` using the following command:

```
VBoxManage controlvm VM-name usbattach device uuid|address --capturefile filename
```

In order to enable capturing on the root hub use the following command while the VM is not running:

```
VBoxManage setextradata VM-name \
VBoxInternal/Devices/usb-ehci/0/LUN#0/Config/CaptureFilename filename
```

The command above enables capturing on the root hub attached to the EHCI controller. To enable it for the OHCI or XHCI controller replace `usb-ehci` with `usb-ohci` or `usb-xhci`, respectively.

Configuring the Heartbeat Service

Oracle VM VirtualBox ships a simple heartbeat service. Once the Guest Additions are active, the guest sends frequent heartbeat pings to the host. If the guest stops sending the heartbeat pings without properly terminating the service, the VM process will log this event in the VBox.log file. In the future it might be possible to configure dedicated actions but for now there is only a warning in the log file.

There are two parameters to configure. The *heartbeat interval* defines the time between two heartbeat pings. The default value is 2 seconds, that is, the heartbeat service of the Oracle VM VirtualBox Guest Additions will send a heartbeat ping every two seconds. The value in nanoseconds can be configured like this:

```
VBoxManage setextradata VM-name \
VBoxInternal/Devices/VMMDev/0/Config/HeartbeatInterval 2000000000
```

The *heartbeat timeout* defines the time the host waits starting from the last heartbeat ping before it defines the guest as unresponsive. The default value is 2 times the heartbeat interval (4 seconds) and can be configured as following, in nanoseconds:

```
VBoxManage setextradata VM-name \
VBoxInternal/Devices/VMMDev/0/Config/HeartbeatTimeout 4000000000
```

If the heartbeat timeout expires, there will be a log message like *VMMDev: HeartBeatCheckTimer: Guest seems to be unresponsive. Last heartbeat received 5 seconds ago.* If another heartbeat ping arrives after this warning, there will be a log message like *VMMDev: GuestHeartBeat: Guest is alive.*

Encryption of Disk Images

Oracle VM VirtualBox enables you to transparently encrypt the data stored in hard disk images for the guest. It does not depend on a specific image format to be used. Images which have the data encrypted are not portable between Oracle VM VirtualBox and other virtualization software.

Oracle VM VirtualBox uses the AES algorithm in XTS mode and supports 128-bit or 256-bit data encryption keys (DEK). The DEK is stored encrypted in the medium properties and is decrypted during VM startup by entering a password which was chosen when the image was encrypted.

Since the DEK is stored as part of the VM configuration file, it is important that it is kept safe. Losing the DEK means that the data stored in the disk images is lost irrecoverably. Having complete and up to date backups of all data related to the VM is the responsibility of the user.

Limitations of Disk Encryption

There are some limitations the user needs to be aware of when using this feature:

- This feature is part of the Oracle VM VirtualBox Extension Pack, which needs to be installed. Otherwise disk encryption is unavailable.
- Since encryption works only on the stored user data, it is currently not possible to check for metadata integrity of the disk image. Attackers might destroy data by removing or changing blocks of data in the image or change metadata items such as the disk size.
- Exporting appliances which contain encrypted disk images is not possible because the OVF specification does not support this. All images are therefore decrypted during export.

- The DEK is kept in memory while the VM is running to be able to decrypt data read and encrypt data written by the guest. While this should be obvious the user needs to be aware of this because an attacker might be able to extract the key on a compromised host and decrypt the data.
- When encrypting or decrypting the images, the password is passed in clear text using the Oracle VM VirtualBox API. This needs to be kept in mind, especially when using third party API clients which make use of the webservice where the password might be transmitted over the network. The use of HTTPS is mandatory in such a case.
- Encrypting images with differencing images is only possible if there are no snapshots or a linear chain of snapshots. This limitation may be addressed in a future Oracle VM VirtualBox version.
- The disk encryption feature can protect the content of the disks configured for a VM only. It does not cover any other data related to a VM, including saved state or the configuration file itself.

Encrypting Disk Images

Encrypting disk images can be done either using VirtualBox Manager or the `VBoxManage`. While VirtualBox Manager is easier to use, it works on a per VM basis and encrypts all disk images attached to the specific VM. With `VBoxManage` one can encrypt individual images, including all differencing images. To encrypt an unencrypted medium with `VBoxManage`, use:

```
VBoxManage encryptmedium uuid|filename \
--newpassword filename|- --cipher cipher-ID --newpasswordid "ID
```

To supply the encryption password point `VBoxManage` to the file where the password is stored or specify `-` to let `VBoxManage` ask you for the password on the command line.

The cipher parameter specifies the cipher to use for encryption and can be either `AES-XTS128-PLAIN64` or `AES-XTS256-PLAIN64`. The specified password identifier can be freely chosen by the user and is used for correct identification when supplying multiple passwords during VM startup.

If the user uses the same password when encrypting multiple images and also the same password identifier, the user needs to supply the password only once during VM startup.

Starting a VM with Encrypted Images

When a VM is started using VirtualBox Manager, a dialog will open where the user needs to enter all passwords for all encrypted images attached to the VM. If another frontend like VBoxHeadless is used, the VM will be paused as soon as the guest tries to access an encrypted disk. The user needs to provide the passwords through `VBoxManage` using the following command:

```
VBoxManage controlvm uuid|vmname addencpassword ID
                     password [--removeonsuspend yes|no]
```

ID must be the same as the password identifier supplied when encrypting the images. *password* is the password used when encrypting the images. Optionally, you can specify `--removeonsuspend` yes|no to specify whether to remove the password from VM memory when the VM is suspended. Before the VM can be resumed, the user needs to supply the passwords again. This is useful when a VM is suspended by a host suspend event and the user does not want the password to remain in memory.

Decrypting Encrypted Images

In some circumstances it might be required to decrypt previously encrypted images. This can be done in VirtualBox Manager for a complete VM or using `VBoxManage` with the following command:

```
VBoxManage encryptmedium uuid|filename --oldpassword file|-
```

The only required parameter is the password the image was encrypted with. The options are the same as for encrypting images.

Paravirtualized Debugging

This section covers debugging of guest operating systems using interfaces supported by paravirtualization providers.

> **Note:**
>
> Paravirtualized debugging significantly alter guest operating system behaviour and should only be used by expert users for debugging and diagnostics.

These debug options are specified as a string of key-value pairs separated by commas. An empty string disables paravirtualized debugging.

Hyper-V Debug Options

All of the options listed below are optional, and thus the default value specified will be used when the corresponding key-value pair is not specified.

- Key: **`enabled`**

  Value: `0` or `1`

  Default: `0`

  Specify `1` to enable the Hyper-V debug interface. If this key-value pair is not specified or the value is not `1`, the Hyper-V debug interface is disabled regardless of other key-value pairs being present.

- Key: **`address`**

  Value: IPv4 address

  Default: 127.0.0.1

  Specify the IPv4 address where the remote debugger is connected.

- Key: **`port`**

  Value: UDP port number

  Default: 50000

  Specify the UDP port number where the remote debugger is connected.

- Key: **`vendor`**

  Value: Hyper-V vendor signature reported by CPUID to the guest

Default: When debugging is enabled: `Microsoft Hv`, otherwise: `VBoxVBoxVBox`

Specify the Hyper-V vendor signature which is exposed to the guest by CPUID. For debugging Microsoft Windows guests, it is required the hypervisor reports the Microsoft vendor.

- Key: **`hypercallinterface`**

  Value: `0` or `1`

  Default: `0`

  Specify whether hypercalls should be suggested for initiating debug data transfers between host and guest rather than MSRs when requested by the guest.

- Key: **`vsinterface`**

  Value: `0` or `1`

  Default: When debugging is enabled, `1`, otherwise `0`

  Specify whether to expose the VS#1 virtualization service interface to the guest. This interface is required for debugging Microsoft Windows 10 32-bit guests, but is optional for other Windows versions.

Setting up Windows Guests for Debugging with the Hyper-V Paravirtualization Provider

Windows supports debugging over a serial cable, USB, IEEE 1394 Firewire, and Ethernet. USB and IEEE 1394 are not applicable for virtual machines, and Ethernet requires Windows 8 or later. While a serial connection is universally usable, it is slow.

Debugging using the Hyper-V debug transport, supported on Windows Vista and later, offers significant benefits. It provides excellent performance due to direct host-to-guest transfers, it is easy to set up and requires minimal support from the hypervisor. It can be used with the debugger running on the same host as the VM or with the debugger and VM on separate machines connected over a network.

Prerequisites

- A VM configured for Hyper-V paravirtualization running a Windows Vista or newer Windows guest. You can check the effective paravirtualization provider for your VM with the output of the following `VBoxManage` command:

  ```
  $ VBoxManage showvminfo VM-name
  ```

- A sufficiently up-to-date version of the Microsoft WinDbg debugger required to debug the version of Windows in your VM.
- While Windows 8 and newer Windows guests ship with Hyper-V debug support, Windows 7 and Vista do not. To use Hyper-V debugging with a Windows 7 or Vista guest, copy the file `kdvm.dll` from a Windows 8.0 installation. This file is typically located in `C:\Windows\System32`. Copy it to the same location in your Windows 7/Vista guest. Make sure you copy the 32-bit or 64-bit version of the DLL which matches your guest OS.

> **Note:**
>
> Only Windows 8.0 ships `kdvm.dll`. Windows 8.1 and newer Windows versions do not.

VM and Guest Configuration

1. Power off the VM.
2. Enable the debug options with the following `VBoxManage` command:

   ```
   $ VBoxManage modifyvm VM-name --paravirt-debug "enabled=1"
   ```

   The above command assumes your debugger will connect to your host machine on UDP port 50000. However, if you need to run the debugger on a remote machine you may specify the remote address and port here. For example:

   ```
   $ VBoxManage modifyvm VM-name \
   --paravirt-debug "enabled=1,address=192.168.32.1,port=55000"
   ```

   See Hyper-V Debug Options for the complete set of options.
3. Start the VM.
4. In the guest, start an elevated command prompt and execute the following commands:
   - For a Windows 8 or newer Windows guest:

     ```
     bcdedit /dbgsettings net hostip:5.5.5.5 port:50000 key:1.2.3.4
     ```
   - For a Windows 7 or Vista guest:

     ```
     bcdedit /set loadoptions host_ip=5.5.5.5,host_port=50000,encryption_key=1.2.3.4

     bcdedit /set dbgtransport kdvm.dll
     ```

     The IP address and port in the `bcdedit` command are ignored when using the Hyper-V debug transport. Any valid IP and a port number greater than 49151 and lower than 65536 can be entered.

     The encryption key in the `bcdedit` command is relevant and must be valid. The key "1.2.3.4" used in the above example is valid and may be used if security is not a concern. If you do not specify any encryption key, `bcdedit` will generate one for you and you will need to copy this key to later enter in Microsoft WinDbg on the remote end. This encryption key is used to encrypt the debug data exchanged between Windows and the debugger.
   - Run one or more of the following commands to enable debugging for the appropriate phase or component of your Windows guest:

     ```
     bcdedit /set debug on

     bcdedit /set bootdebug on

     bcdedit /set {bootmgr} bootdebug on
     ```

     Please note that the `bootdebug` options are only effective on Windows 8 or newer when using the Hyper-V debug transport. Refer to Microsoft Windows documentation for detailed explanation of `bcdedit` options.
5. Start Microsoft WinDbg on your host machine or remote host.

From the **File** menu, select **Kernel Debug**. On the **NET** tab, specify the UDP port number you used in the `paravirtdebug` options. If you did not specify any, leave it as 50000. Ensure that the UDP port is not blocked by a firewall or other security software.

In the **Key** field, enter `1.2.3.4` or the encryption key from the `bcdedit` command in your Windows guest.

Click **OK** to start listening for connections. Microsoft WinDbg typically shows a Waiting to Reconnect message during this phase.

Alternatively, to directly start a debug session, run WinDbg from the command line as follows :

```
windbg.exe -k net:port=50000,key=1.2.3.4
```

See the WinDbg documentation for the complete command line syntax.

6. Reboot your Windows guest and it should then connect as a debuggee with Microsoft WinDbg.

PC Speaker Passthrough

As an experimental feature, primarily due to being limited to Linux host only and unknown Linux distribution coverage, Oracle VM VirtualBox supports passing through the PC speaker to the host. The PC speaker, sometimes called the system speaker, is a way to produce audible feedback such as beeps without the need for regular audio and sound card support.

The PC speaker passthrough feature in Oracle VM VirtualBox handles beeps only. Advanced PC speaker use by the VM, such as PCM audio, will not work, resulting in undefined host behavior.

Producing beeps on Linux is a very complex topic. Oracle VM VirtualBox offers a collection of options, in an attempt to make this work deterministically and reliably on as many Linux distributions and system configurations as possible. These are summarized in the following table.

Table 9-4 PC Speaker Configuration Options

Code	Device	Notes
1	`/dev/input/by-path/platform-pcspkr-event-spkr`	Direct host PC speaker use.
2	`/dev/tty`	Uses the terminal association of the VM process. VM needs to be started on a virtual console.
3	`/dev/tty0` or `/dev/vc/0`	Can only be used by user `root` or users with `cap_sys_tty_config` capability.
9	A user-specified console or evdev device path.	As for codes 1 to 3, but with a custom device path.
70	`/dev/tty`	Standard beep only. Loses frequency and length. See code 2.
79	A user-specified terminal device path.	As for code 70, but with a custom device path.

Table 9-4 (Cont.) PC Speaker Configuration Options

Code	Device	Notes
100	All of the above.	Tries all the available codes.

To enable PC speaker passthrough use the following command:

```
VBoxManage setextradata VM-name "VBoxInternal/Devices/i8254/0/Config/PassthroughSpeaker"
N
```

Replace *N* with the code representing the case you want to use. Changing this setting takes effect when you next start the VM. It is safe to enable PC speaker passthrough on all host OSes. It will only have an effect on Linux.

The VM log file, `VBox.log`, contains lines with the prefix `PIT: speaker:` showing the PC speaker passthrough setup activities. It gives hints which device it picked or why it failed.

Enabling PC speaker passthrough for the VM is usually the simple part. The real difficulty is making sure that Oracle VM VirtualBox can access the necessary device, because in a typical Linux install most of them can only be accessed by user `root`. You should follow the preferred way to persistently change this, such as by referring to your distribution's documentation. Since there are countless Linux distribution variants, we can only give the general hints that there is often a way to give the X11 session user access to additional devices, or you need to find a working solution using a udev configuration file. If everything fails you might try setting the permissions using a script which is run late enough in the host system startup.

Sometimes additional rules are applied by the kernel to limit access. For example, that the VM process must have the same controlling terminal as the device configured to be used for beeping, something which is often very difficult to achieve for GUI applications such as Oracle VM VirtualBox. The table above contains some hints, but in general refer to the Linux documentation.

If you have trouble getting any beeps even if the device permissions are set up and VBox.log confirms that it uses evdev or console for the PC speaker control, check if your system has a PC speaker. Some systems do not have one. Other complications can arise from Linux rerouting the PC speaker output to a sound card. Check if the beeps are audible if you connect speakers to your sound card. Today almost all systems have one. Finally, check if the audio mixer control has a channel named "beep", which could be hidden in the mixer settings, and that it is not muted.

Accessing USB devices Exposed Over the Network with USB/IP

Oracle VM VirtualBox supports passing through USB devices which are exposed over the network using the USB over IP protocol without the need to configure the client side provided by the kernel and usbip tools. Furthermore, this feature works with Oracle VM VirtualBox running on any supported host, rather than just Linux alone, as is the case with the official client.

To enable support for passing through USB/IP devices, use the following command to add the device server that exports the devices:

```
VBoxManage usbdevsource add unique-name --backend USBIP --address device-server[:port]
```

USB devices exported on the device server are then accessible through VirtualBox Manager or `VBoxManage`, like any USB devices attached locally. This can be used multiple times to access different device servers.

To remove a device server, the following command can be used:

```
$ VBoxManage usbdevsource remove unique-name
```

Setting up USB/IP Support on a Linux System

This section gives a brief overview on how to set up a Linux based system to act as a USB device server. The system on the server requires that the `usbip-core.ko` and `usbip-host.ko` kernel drivers are available, and that the USB/IP tools package is installed. The particular installation method for the necessary tools depends on which distribution is used. For example, for Debian based systems, use the following command to install the required tools:

```
$ apt-get install usbip-utils
```

To check whether the necessary tools are already installed use the following command:

```
$ usbip list -l
```

This should produce output similar to that shown in the example below:

```
 - busid 4-2 (0bda:0301)
   Realtek Semiconductor Corp. : multicard reader (0bda:0301)

 - busid 5-1 (046d:c52b)
   Logitech, Inc. : Unifying Receiver (046d:c52b)
```

If everything is installed, the USB/IP server needs to be started as `root` using the following command:

```
# usbipd -D
```

See the documentation for the installed distribution to determine how to start the service when the system boots.

By default, no device on the server is exported. This must be done manually for each device. To export a device use the following command:

```
# usbip bind -b "bus identifier"
```

To export the multicard reader in the previous example:

```
# usbip bind -b 4-2
```

Security Considerations

The communication between the server and client is unencrypted and there is no authorization required to access exported devices. An attacker might sniff sensitive data or gain control over a device. To mitigate this risk, the device should be exposed over a local network to which only trusted clients have access. To access the device remotely over a public network, a VPN solution should be used to provide the required level of security protection.

Using Hyper-V with Oracle VM VirtualBox

Oracle VM VirtualBox can be used on a Windows host where Hyper-V is running. This is an experimental feature.

No configuration is required. Oracle VM VirtualBox detects Hyper-V automatically and uses Hyper-V as the virtualization engine for the host system. The CPU icon in the VM window status bar indicates that Hyper-V is being used.

> **Note:**
>
> When using this feature, some host systems might experience significant Oracle VM VirtualBox performance degradation.

Nested Virtualization

Oracle VM VirtualBox supports *nested virtualization*. This feature enables the passthrough of hardware virtualization functions to the guest VM. That means that you can install a hypervisor, such as Oracle VM VirtualBox, Oracle VM Server or KVM, on an Oracle VM VirtualBox guest. You can then create and run VMs within the guest VM.

Hardware virtualization features not present on the host CPU will not be exposed to the guest. In addition, some features such as nested paging are not yet supported for passthrough to the guest.

You can enable the nested virtualization feature in one of the following ways:

- From VirtualBox Manager, select the **Enable Nested VT-x/AMD-V** check box on the **Processor** tab. To disable the feature, deselect the check box.
- Use the `--nested-hw-virt` option of the `VBoxManage modifyvm` command to enable or disable nested virtualization. See VBoxManage modifyvm.

VBoxSVC running in Windows Session 0

Oracle VM VirtualBox supports executing the VBoxSVC in Windows session 0. This allows VBoxSVC to run like a regular Windows service, which in turn enables headless VMs to continue running even if the user logs out.

> **Note:**
>
> This is currently an experimental feature.

The feature is disabled by default and can be enabled by creating a REG_DWORD value `ServerSession0` in the key `HKEY_LOCAL_MACHINE\Software\Oracle\VirtualBox\VBoxSDS` of the Windows registry. Specify `1` as the value's data to enable the feature, or `0` to disable the feature. A host reboot is needed in order to make the change effective.

Known Issues

- Due to different Windows sessions having their own set of resources, there might be some issues with accessing network shares created in the interactive user session when at least one of the Oracle VM VirtualBox processes are running in session 0.

  For accessing network shares within session 0, a possible workaround is to establish permanent access to the share and then restart the host.

VISO file format / RTIsoMaker

ISO image maker

Synopsis

`RTIsoMaker [`*options*`] [@`*commands.rsp*`] <`*filespec...*`>`

Description

Construct a virtual ISO 9660 / Joliet / UDF / HFS hybrid image and either write it to a file (RTIsoMaker) or serve it as a virtual image (VISO).

VISO file format

A VISO file is a virtual ISO image, i.e. constructed in memory from a bunch of files on the host. A VISO is just the recipe describing how to go about this using a syntax vaguely similar to mkisofs and genisoimage.

One requirement is that the VISO file must start with one of the `--iprt-iso-maker-file-marker` options. Which of the options you use will dictate the quoting and escaping rules used when reading the file. The option takes the image UUID as an argument.

The VISO files are treated as UTF-8 and must not contain any byte order marker (BOM). There is currently no way to comment out lines in a VISO file.

File specifications and --name-setup

All non-options that does not start with '@' are taken to indicate a file, directory, or similar that is should be added to the ISO image. Directories are added recursively and content is subject to filtering options.

Since there can be up to six different namespaces on an ISO, it is handy to be able to control the names used in each and be able to exclude an object from one or more namespaces. The `--name-setup` option specifies the file specification format to use forthwith.

The default setup is:

```
--name-setup iso+joliet+udf+hfs
```

Which means you specify one on-ISO name for all namespaces followed by '=' and the source file system name. Only specifying the source file system will add the file/dir/whatever to the root of the ISO image.

Lets look at the following two examples:

```
/docs/readme.txt=/home/user/Documents/product-x-readme.txt
```

```
/home/user/Documents/product-x-readme.txt
```

In the first case the file `'/home/user/Documents/product-x-readme.txt'` is added to the ISO image as `'/docs/readme.txt'` in all enabled namespaces. In the primary ISO 9660 namespace, the filename will by default be converted to upper case because it's required by the spec.

In the second case the file is added to the root under the name `'product-x-readme.txt'` in all namespaces. Though, in the primary ISO 9660 namespace the name will be transformed to apply with the current ISO level, probably uppercased, possibly truncated too.

Given `--name-setup iso,joliet,udf` you can specify the name individually for each of the three namespace, if you like. If you omit any, they will use last name given. Any names left blank (==) will be considered omitted.

A different name in each namespace:

```
/ISO.TXT=/Joliet.TxT=/UDF.txt=/tmp/iso/real.txt
```

Specific name in the ISO 9660 namespace, same in the rest:

```
/ISO.TXT=/OtherNamespaces.TxT=/tmp/iso/real.txt
```

Omit the file from the ISO 9660 namespace:

```
=/OtherNamespaces.TxT=/tmp/iso/real.txt
```

Omit the file from the joliet namespace:

```
/ISO.TXT==/UDF.TxT=/tmp/iso/real.txt
```

Use the same filename as the source everywhere:

```
/tmp/iso/real.txt
```

Using for instance `--name-setup udf` you can add a files/dirs/whatever to select namespace(s) without the more complicated empty name syntax above.

When adding directories, you can only control the naming and omitting of the directory itself, not any recursively added files and directories below it.

Options

General

`-o` *output-file*
`--output=` *output-file*
The output filename. This option is not supported in VISO mode.

`--name-setup=` *spec*
Configures active namespaces and how file specifications are to be interpreted. The specification is a comma separated list. Each element in the list is a sub-list separated by space, `'+'` or `'|'` giving the namespaces that elements controls. Namespaces are divied into two major and minor ones, you cannot specifying a minor before the major it belongs to. Major namespaces and aliases in parentheses:

- iso (primary, iso9660, iso-9660, primary-iso, iso-primary)
- joliet
- udf
- hfs (hfs-plus)

Minor namespaces:

- rock: rock ridge on previous major namespace (iso / joliet)
- iso-rock: rock ridge extensions on primary ISO 9660 namespace
- joliet-rock: rock ridge on joliet namespace (just for fun)
- trans-tbl: translation table file on previous major namespace
- iso-trans-tbl
- joliet-trans-tbl
- udf-trans-tbl
- hfs-trans-tbl

`--name-setup-from-import`
This is for use following one or more `--import-iso` operations and will pick a configuration matching the imported content as best we can. If the imported ISOs only had a iso9660 namespace, the joliet, udf and hfs namespaces will be removed. This is useful when adding additional files to the ISO and will prevent guest from picking a namespace without the imported ISO content when mounting it.

`--push-iso=` ***iso-file***
`--push-iso-no-joliet=` ***iso-file***
`--push-iso-no-rock-` ***iso-file***
`--push-iso-no-rock-no-joliet=` ***iso-file***
Open the specified ISO file and use it as source file system until the corresponding `--pop` options is encountered. The variations are for selecting which namespace on the ISO to (not) access. These options are handy for copying files/directories/stuff from an ISO without having to extract them first or using the `:iprtvfs:` syntax.

`--pop`
Pops a `--push-iso` of the source file system stack.

`--import-iso=` ***iso-file***
Imports everything on the given ISO file, including boot configuration and system area (first 16 sectors) content. You can use `--name-setup` to omit namespaces.

Namespaces

`--iso-level=` ***0|1|2|3***
Sets the ISO level:

- 0: Disable primary ISO namespace.
- 1: ISO level 1: Filenames 8.3 format and limited to 4GB - 1.
- 2: ISO level 2: 31 char long names and limited to 4GB - 1.
- 3: ISO level 3: 31 char long names and support for >=4GB files. (default)

- 4: Fictive level used by other tools. Not yet implemented.

--rock-ridge
--limited-rock-ridge
--no-rock-ridge
Enables or disables rock ridge support for the primary ISO 9660 namespace. The `--limited-rock-ridge` option omits a couple of bits in the root directory that would make Linux pick rock ridge over joliet.
Default: `--limited-rock-ridge`

-J
--joliet
--no-joliet
Enables or disable the joliet namespace. This option must precede any file specifications.
Default: `--joliet`

--joliet-ucs-level= ***1|2|3***
--ucs-level= ***1|2|3***
Set the Joliet UCS support level. This is currently only flagged in the image but not enforced on the actual path names.
Default level: 3

File Attributes

--rational-attribs
Enables rational file attribute handling (default):

- Owner ID is set to zero
- Group ID is set to zero
- Mode is set to 0444 for non-executable files.
- Mode is set to 0555 for executable files.
- Mode is set to 0555 for directories, preserving stick bits.

--strict-attribs
Counters `--rational-attribs` and causes attributes to be recorded exactly as they appear in the source.

--file-mode= ***mode***
--no-file-mode
Controls the forced file mode mask for rock ridge, UDF and HFS.

--dir-mode= ***mode***
--no-dir-mode
Controls the forced directory mode mask for rock ridge, UDF and HFS.

--new-dir-mode= ***mode***
Controls the default mode mask (rock ridge, UDF, HFS) for directories that are created implicitly. The `--dir-mode` option overrides this.

--chmod= ***mode*** **:** ***on-iso-file***
Explictly sets the rock ridge, UDF and HFS file mode for a file/dir/whatever that has already been added to the ISO. The mode can be octal, `ra+x`, `a+r`, or `a+rx`. (Support for more complicated mode specifications may be implemented at a later point.)
Note that only namespaces in the current --name-setup are affected.

`--chown=` *owner-id* `:` *on-iso-file*
Explictily sets the rock ridge, UDF and HFS file owner ID (numeric) for a file/dir/whatever that has already been added to the ISO.
Note that only namespaces in the current --name-setup are affected.

--chgrp=*group-id*:*on-iso-file*
Explictily sets the rock ridge, UDF and HFS file group ID (numeric) for a file/dir/whatever that has already been added to the ISO.
Note that only namespaces in the current --name-setup are affected.

Booting

`--eltorito-new-entry`
`--eltorito-alt-boot`
Starts a new El Torito boot entry.

`--eltorito-add-image=` *filespec*
File specification of a file that should be added to the image and used as the El Torito boot image of the current boot entry.

`-b` *on-iso-file*
`--eltorito-boot=` *on-iso-file*
Specifies a file on the ISO as the El Torito boot image for the current boot entry.

`--eltorito-floppy-12`
`--eltorito-floppy-144`
`--eltorito-floppy-288`
`--no-emulation-boot`
`--hard-disk-boot`
Sets the boot image emulation type of the current El Torito boot entry.

`--boot-load-seg=` *seg*
Specify the image load segment for the current El Torito boot entry.
Default: 0x7c0

`--boot-load-size=` *sectors*
Specify the image load size in emulated sectors for the current El Torito boot entry.
Default: 4 (sectors of 512 bytes)

`--no-boot`
Indicates that the current El Torito boot entry isn't bootable. (The BIOS will allegedly configure the emulation, but not attempt booting.)

`--boot-info-table`
Write a isolinux/syslinux boot info table into the boot image for the current El Torito boot entry.

`--eltorito-platform-id=` *id*
Set the El Torito platform ID of the current entry, a new entry of the verification entry depending on when it's used. The ID must be one of: `x86`, `PPC`, `Mac`, `efi`

`-c` *namespec*
`--boot-catalog=` *namespec*
Enters the El Torito boot catalog into the namespaces as a file. The *namespec* uses the same format as a 'filespec', but omits the final source file system name component.

-G *file*
--generic-boot= *file*
Specifies a file that should be loaded at offset 0 in the ISO image. The file must not be larger than 32KB. When creating a hybrid image, parts of this may be regenerated by partition tables and such.

String properties (applied to active namespaces only)

--abstract= *file-id*
The name of the abstract file in the root dir.

-A *text|_file-id*
--application-id= *text|_file-id*
Application ID string or root file name. The latter must be prefixed with an underscore.

--biblio= *file-id*
The name of the bibliographic file in the root dir.

--copyright= *file-id*
The name of the copyright file in the root dir.

-P *text|_file-id*
--publisher= *text|_file-id*
Publisher ID string or root file name. The latter must be prefixed with an underscore.

-p *text|_file-id*
--preparer= *text|_file-id*
Data preparer ID string or root file name. The latter must be prefixed with an underscore.

--sysid= *text*
System ID string.

--volid= *text*
--volume-id= *text*
Volume ID string (label). (It is possible to set different labels for primary ISO 9660, joliet, UDF and HFS by changing the active namespaces using the `--name-setup` option between `--volume-id` occurences.)

--volset= *text*
Volume set ID string.

Compatibility:

--graft-points
Alias for --name-setup iso+joliet+udf+hfs.

-l
--long-names
Allow 31 charater filenames. Just ensure ISO level >= 2 here.

-R
--rock
Same as `--rock-ridge` and `--strict-attribs`.

-r
--rational-rock
Same as `--rock-ridge` and `--rational-attribs`.

VISO Specific:

--iprt-iso-maker-file-marker= ***UUID***
--iprt-iso-maker-file-marker-bourne= ***UUID***
--iprt-iso-maker-file-marker-bourne-sh= ***UUID***
Used as first option in a VISO file to specify the file UUID and that it is formatted using bourne-shell argument quoting & escaping style.

--iprt-iso-maker-file-marker-ms= ***UUID***
--iprt-iso-maker-file-marker-ms-sh= ***UUID***
Used as first option in a VISO file to specify the file UUID and that it is formatted using microsoft CRT argument quoting & escaping style.

Testing (not applicable to VISO):

--output-buffer-size= ***bytes***
Selects a specific output buffer size for testing virtual image reads.

--random-output-buffer-size
Enables randomized buffer size for each virtual image read, using the current output buffer size (`--output-buffer-size`) as maximum.

--random-order-verification= ***size***
Enables verification pass of the image that compares blocks of the given size in random order from the virtual and output images.

10

Technical Background

This chapter provides additional information for readers who are familiar with computer architecture and technology and wish to find out more about how Oracle VM VirtualBox works *under the hood*. The contents of this chapter are not required reading in order to use Oracle VM VirtualBox successfully.

Where Oracle VM VirtualBox Stores its Files

In Oracle VM VirtualBox, a virtual machine and its settings are described in a virtual machine settings file in XML format. In addition, most virtual machines have one or more virtual hard disks. These are typically represented by disk images, such as those in VDI format. The location of these files may vary, depending on the host operating system. See The Machine Folder.

Global configuration data for Oracle VM VirtualBox is maintained in another location on the host. See Global Settings.

The Machine Folder

By default, each virtual machine has a directory on your host computer where all the files of that machine are stored: the XML settings file, with a `.vbox` file extension, and its disk images. This is called the *machine folder*.

By default, this machine folder is located in a common folder called `VirtualBox VMs`, which Oracle VM VirtualBox creates in the current system user's home directory. The location of this home directory depends on the conventions of the host operating system, as follows:

- On Windows, this is the location returned by the `SHGetFolderPath` function of the Windows system library Shell32.dll, asking for the user profile. A typical location is `C:\Users\`*`username`* .
- On Linux, macOS, and Oracle Solaris, this is generally taken from the environment variable `$HOME`, except for the user `root` where it is taken from the account database. This is a workaround for the frequent trouble caused by users using Oracle VM VirtualBox in combination with the tool `sudo`, which by default does not reset the environment variable `$HOME`.

  A typical location on Linux and Oracle Solaris is `/home/`*`username`* and on macOS is `/Users/`*`username`* .

For simplicity, we abbreviate the location of the home directory as `$HOME`. Using that convention, the common folder for all virtual machines is `$HOME/VirtualBox VMs`.

As an example, when you create a virtual machine called "Example VM", Oracle VM VirtualBox creates the following:

- A machine folder: `$HOME/VirtualBox VMs/Example VM/`
- In the machine folder, a settings file: `Example VM.vbox`
- In the machine folder, a virtual disk image: `Example VM.vdi`.

This is the default layout if you use the **Create New Virtual Machine** wizard described in Creating Your First Virtual Machine. Once you start working with the VM, additional files are added. Log files are in a subfolder called `Logs`, and if you have taken snapshots, they are in a `Snapshots` subfolder. For each VM, you can change the location of its snapshots folder in the VM settings.

You can change the default machine folder by selecting **Preferences** from the **File** menu in the Oracle VM VirtualBox main window. Then, in the displayed window, click on the **General** tab. Alternatively, use the `VBoxManage setproperty machinefolder` command. See VBoxManage setproperty.

Global Settings

In addition to the files for the virtual machines, Oracle VM VirtualBox maintains global configuration data in the following directory:

- **Linux and Oracle Solaris:**`$HOME/.config/VirtualBox`.
- **Windows:**`$HOME/.VirtualBox`.
- **macOS:**`$HOME/Library/VirtualBox`.

Oracle VM VirtualBox creates this configuration directory automatically, if necessary. You can specify an alternate configuration directory by either setting the `VBOX_USER_HOME` environment variable, or on Linux or Oracle Solaris by using the standard `XDG_CONFIG_HOME` variable. Since the global `VirtualBox.xml` settings file points to all other configuration files, this enables switching between several Oracle VM VirtualBox configurations.

In this configuration directory, Oracle VM VirtualBox stores its global settings file, an XML file called `VirtualBox.xml`. This file includes global configuration options and a list of registered virtual machines with pointers to their XML settings files.

Summary of Configuration Data Locations

The following table gives a brief overview of the configuration data locations on an Oracle VM VirtualBox host.

Table 10-1 Configuration File Locations

Setting	Location
Default machines folder	`$HOME/VirtualBox VMs`
Default disk image location	In each machine's folder
Machine settings file extension	`.vbox`
Media registry	Each machine settings file Media registration is done automatically when a storage medium is attached to a VM

Oracle VM VirtualBox XML Files

Oracle VM VirtualBox uses XML for both the machine settings files and the global configuration file, `VirtualBox.xml`.

All Oracle VM VirtualBox XML files are versioned. When a new settings file is created, for example because a new virtual machine is created, Oracle VM VirtualBox automatically uses

the settings format of the current Oracle VM VirtualBox version. These files may not be readable if you downgrade to an earlier version of Oracle VM VirtualBox. However, when Oracle VM VirtualBox encounters a settings file from an earlier version, such as after upgrading Oracle VM VirtualBox, it attempts to preserve the settings format as much as possible. It will only silently upgrade the settings format if the current settings cannot be expressed in the old format, for example because you enabled a feature that was not present in an earlier version of Oracle VM VirtualBox.

In such cases, Oracle VM VirtualBox backs up the old settings file in the virtual machine's configuration directory. If you need to go back to the earlier version of Oracle VM VirtualBox, then you will need to manually copy these backup files back.

We intentionally do not document the specifications of the Oracle VM VirtualBox XML files, as we must reserve the right to modify them in the future. We therefore strongly suggest that you do not edit these files manually. Oracle VM VirtualBox provides complete access to its configuration data through its the `VBoxManage` command line tool, see VBoxManage and its API, see Oracle VM VirtualBox Programming Interfaces.

Oracle VM VirtualBox Executables and Components

Oracle VM VirtualBox was designed to be modular and flexible. When the Oracle VM VirtualBox graphical user interface (GUI) is opened and a VM is started, at least the following three processes are running:

- `VBoxSVC`, the Oracle VM VirtualBox service process which always runs in the background. This process is started automatically by the first Oracle VM VirtualBox client process and exits a short time after the last client exits. The first Oracle VM VirtualBox service can be VirtualBox Manager, `VBoxManage`, `VBoxHeadless`, the web service amongst others. The service is responsible for bookkeeping, maintaining the state of all VMs, and for providing communication between Oracle VM VirtualBox components. This communication is implemented using COM/XPCOM.

  > **Note:**
  >
  > When we refer to *clients* here, we mean the local clients of a particular `VBoxSVC` server process, not clients in a network. Oracle VM VirtualBox employs its own client/server design to allow its processes to cooperate, but all these processes run under the same user account on the host operating system, and this is totally transparent to the user.

- The GUI process, `VirtualBoxVM`, a client application based on the cross-platform Qt library. When started without the `--startvm` option, this application acts as VirtualBox Manager, displaying the VMs and their settings. It then communicates settings and state changes to `VBoxSVC` and also reflects changes effected through other means, such as the `VBoxManage` command.
- If the `VirtualBoxVM` client application is started with the `--startvm` argument, it loads the VMM library which includes the actual hypervisor and then runs a virtual machine and provides the input and output for the guest.

Any Oracle VM VirtualBox front-end, or client, will communicate with the service process and can both control and reflect the current state. For example, either the VM selector or the VM window or VBoxManage can be used to pause the running VM, and other components will always reflect the changed state.

The Oracle VM VirtualBox GUI application, called VirtualBox Manager, is only one of several available front ends, or clients. The complete list shipped with Oracle VM VirtualBox is as follows:

- `VirtualBoxVM`: The Qt front end implementing VirtualBox Manager and running VMs.
- `VBoxManage`: A less user-friendly but more powerful alternative. See VBoxManage.
- `VBoxHeadless`: A VM front end which does not directly provide any video output and keyboard or mouse input, but enables redirection through the VirtualBox Remote Desktop Extension. See VBoxHeadless, the Remote Desktop Server.
- `vboxwebsrv`: The Oracle VM VirtualBox web service process which enables control of an Oracle VM VirtualBox host remotely. This is described in detail in the Oracle VM VirtualBox Software Development Kit (SDK) reference. See Oracle VM VirtualBox Programming Interfaces.
- The Oracle VM VirtualBox Python shell: A Python alternative to `VBoxManage`. This is also described in the SDK reference.

Internally, Oracle VM VirtualBox consists of many more or less separate components. You may encounter these when analyzing Oracle VM VirtualBox internal error messages or log files. These include the following:

- IPRT: A portable runtime library which abstracts file access, threading, and string manipulation. Whenever Oracle VM VirtualBox accesses host operating features, it does so through this library for cross-platform portability.
- VMM (Virtual Machine Monitor): The heart of the hypervisor.
- EM (Execution Manager): Controls execution of guest code.
- TRPM (Trap Manager): Intercepts and processes guest traps and exceptions.
- HM (Hardware Acceleration Manager): Provides support for VT-x and AMD-V.
- GIM (Guest Interface Manager): Provides support for various paravirtualization interfaces to the guest.
- PDM (Pluggable Device Manager): An abstract interface between the VMM and emulated devices which separates device implementations from VMM internals and makes it easy to add new emulated devices. Through PDM, third-party developers can add new virtual devices to Oracle VM VirtualBox without having to change Oracle VM VirtualBox itself.
- PGM (Page Manager): A component that controls guest paging.
- TM (Time Manager): Handles timers and all aspects of time inside guests.
- CFGM (Configuration Manager): Provides a tree structure which holds configuration settings for the VM and all emulated devices.
- SSM (Saved State Manager): Saves and loads VM state.
- VUSB (Virtual USB): A USB layer which separates emulated USB controllers from the controllers on the host and from USB devices. This component also enables remote USB.
- DBGF (Debug Facility): A built-in VM debugger.
- Oracle VM VirtualBox emulates a number of devices to provide the hardware environment that various guests need. Most of these are standard devices found in many PC compatible machines and widely supported by guest operating systems. For network and storage devices in particular, there are several options for the emulated devices to access the underlying hardware. These devices are managed by PDM.
- Guest Additions for various guest operating systems. This is code that is installed from within a virtual machine. See Guest Additions.

- The "Main" component is special. It ties all the above bits together and is the only public API that Oracle VM VirtualBox provides. All the client processes listed above use only this API and never access the hypervisor components directly. As a result, third-party applications that use the Oracle VM VirtualBox Main API can rely on the fact that it is always well-tested and that all capabilities of Oracle VM VirtualBox are fully exposed. It is this API that is described in the Oracle VM VirtualBox SDK. See Oracle VM VirtualBox Programming Interfaces.

Hardware Virtualization

Oracle VM VirtualBox enables software in the virtual machine to run directly on the processor of the host, but an array of complex techniques is employed to intercept operations that would interfere with your host. Whenever the guest attempts to do something that could be harmful to your computer and its data, Oracle VM VirtualBox steps in and takes action. In particular, for lots of hardware that the guest believes to be accessing, Oracle VM VirtualBox simulates a certain *virtual* environment according to how you have configured a virtual machine. For example, when the guest attempts to access a hard disk, Oracle VM VirtualBox redirects these requests to whatever you have configured to be the virtual machine's virtual hard disk. This is normally an image file on your host.

Unfortunately, the x86 platform was never designed to be virtualized. Detecting situations in which Oracle VM VirtualBox needs to take control over the guest code that is executing, as described above, is difficult. To achieve this, Oracle VM VirtualBox uses *hardware virtualization*.

Intel and AMD processors have support for hardware virtualization. This means that these processors can help Oracle VM VirtualBox to intercept potentially dangerous operations that a guest operating system may be attempting and also makes it easier to present virtual hardware to a virtual machine.

These hardware features differ between Intel and AMD processors. Intel named its technology VT-x, AMD calls theirs AMD-V. The Intel and AMD support for virtualization is very different in detail, but not very different in principle.

> **Note:**
>
> On many systems, the hardware virtualization features first need to be enabled in the BIOS before Oracle VM VirtualBox can use them.

Enabling hardware virtualization is *required* in the following scenarios:

- Certain rare guest operating systems like OS/2 make use of very esoteric processor instructions. For virtual machines that are configured to use such an operating system, hardware virtualization is enabled automatically.
- Oracle VM VirtualBox's 64-bit guest and multiprocessing (SMP) support both require hardware virtualization to be enabled. This is not much of a limitation since the vast majority of 64-bit and multicore CPUs ship with hardware virtualization. The exceptions to this rule are some legacy Intel and AMD CPUs.

> **Caution:**
>
> Do not run other hypervisors, either open source or commercial virtualization products, together with Oracle VM VirtualBox. While several hypervisors can normally be *installed* in parallel, do not attempt to *run* several virtual machines from competing hypervisors at the same time. Oracle VM VirtualBox cannot track what another hypervisor is currently attempting to do on the same host, and especially if several products attempt to use hardware virtualization features such as VT-x, this can crash the entire host.

See Details About Hardware Virtualization for a technical discussion of hardware virtualization.

Details About Hardware Virtualization

With Intel VT-x, there are two distinct modes of CPU operation: VMX root mode and non-root mode.

- In root mode, the CPU operates much like older generations of processors without VT-x support. There are four privilege levels, called rings, and the same instruction set is supported, with the addition of several virtualization specific instruction. Root mode is what a host operating system without virtualization uses, and it is also used by a hypervisor when virtualization is active.
- In non-root mode, CPU operation is significantly different. There are still four privilege rings and the same instruction set, but a new structure called VMCS (Virtual Machine Control Structure) now controls the CPU operation and determines how certain instructions behave. Non-root mode is where guest systems run.

Switching from root mode to non-root mode is called "VM entry", the switch back is "VM exit". The VMCS includes a guest and host state area which is saved/restored at VM entry and exit. Most importantly, the VMCS controls which guest operations will cause VM exits.

The VMCS provides fairly fine-grained control over what the guests can and cannot do. For example, a hypervisor can allow a guest to write certain bits in shadowed control registers, but not others. This enables efficient virtualization in cases where guests can be allowed to write control bits without disrupting the hypervisor, while preventing them from altering control bits over which the hypervisor needs to retain full control. The VMCS also provides control over interrupt delivery and exceptions.

Whenever an instruction or event causes a VM exit, the VMCS contains information about the exit reason, often with accompanying detail. For example, if a write to the CR0 register causes an exit, the offending instruction is recorded, along with the fact that a write access to a control register caused the exit, and information about source and destination register. Thus the hypervisor can efficiently handle the condition without needing advanced techniques such as CSAM and PATM described above.

VT-x inherently avoids several of the problems which software virtualization faces. The guest has its own completely separate address space not shared with the hypervisor, which eliminates potential clashes. Additionally, guest OS kernel code runs at privilege ring 0 in VMX non-root mode, obviating the problems by running ring 0 code at less privileged levels. For example the SYSENTER instruction can transition to ring 0 without causing problems. Naturally, even at ring 0 in VMX non-root mode, any I/O access by guest code still causes a VM exit, allowing for device emulation.

The biggest difference between VT-x and AMD-V is that AMD-V provides a more complete virtualization environment. VT-x requires the VMX non-root code to run with paging enabled,

which precludes hardware virtualization of real-mode code and non-paged protected-mode software. This typically only includes firmware and OS loaders, but nevertheless complicates VT-x hypervisor implementation. AMD-V does not have this restriction.

Of course hardware virtualization is not perfect. Compared to software virtualization, the overhead of VM exits is relatively high. This causes problems for devices whose emulation requires high number of traps. One example is a VGA device in 16-color mode, where not only every I/O port access but also every access to the framebuffer memory must be trapped.

Paravirtualization Providers

Oracle VM VirtualBox enables the exposure of a paravirtualization interface, to facilitate accurate and efficient execution of software within a virtual machine. These interfaces require the guest operating system to recognize their presence and make use of them in order to leverage the benefits of communicating with the Oracle VM VirtualBox hypervisor.

Most modern, mainstream guest operating systems, including Windows and Linux, ship with support for one or more paravirtualization interfaces. Hence, there is typically no need to install additional software in the guest to take advantage of this feature.

Exposing a paravirtualization provider to the guest operating system does not rely on the choice of host platforms. For example, the *Hyper-V* paravirtualization provider can be used for VMs to run on any host platform supported by Oracle VM VirtualBox and not just Windows.

Oracle VM VirtualBox provides the following interfaces:

- **Minimal**: Announces the presence of a virtualized environment. Additionally, reports the TSC and APIC frequency to the guest operating system. This provider is mandatory for running any Mac OS X guests.
- **KVM**: Presents a Linux KVM hypervisor interface which is recognized by Linux kernels version 2.6.25 or later. Oracle VM VirtualBox's implementation currently supports paravirtualized clocks and SMP spinlocks. This provider is recommended for Linux guests.
- **Hyper-V**: Presents a Microsoft Hyper-V hypervisor interface which is recognized by Windows 7 and newer operating systems. Oracle VM VirtualBox's implementation currently supports paravirtualized clocks, APIC frequency reporting, guest debugging, guest crash reporting and relaxed timer checks. This provider is recommended for Windows guests.

Nested Paging and VPIDs

In addition to normal hardware virtualization, your processor may also support the following additional sophisticated techniques:

- Nested paging implements some memory management in hardware, which can greatly accelerate hardware virtualization since these tasks no longer need to be performed by the virtualization software.

  With nested paging, the hardware provides another level of indirection when translating linear to physical addresses. Page tables function as before, but linear addresses are now translated to "guest physical" addresses first and not physical addresses directly. A new set of paging registers now exists under the traditional paging mechanism and translates from guest physical addresses to host physical addresses, which are used to access memory.

  Nested paging eliminates the overhead caused by VM exits and page table accesses. In essence, with nested page tables the guest can handle paging without intervention from the hypervisor. Nested paging thus significantly improves virtualization performance.

On AMD processors, nested paging has been available starting with the Barcelona (K10) architecture. They now call it rapid virtualization indexing (RVI). Intel added support for nested paging, which they call extended page tables (EPT), with their Core i7 (Nehalem) processors.

If nested paging is enabled, the Oracle VM VirtualBox hypervisor can also use *large pages* to reduce TLB usage and overhead. This can yield a performance improvement of up to 5%. To enable this feature for a VM, you use the `VBoxManage modifyvm --large-pages` command. See VBoxManage modifyvm.

If you have an Intel CPU with EPT, please consult CVE-2018-3646 for security concerns regarding EPT.

- On Intel CPUs, a hardware feature called Virtual Processor Identifiers (VPIDs) can greatly accelerate context switching by reducing the need for expensive flushing of the processor's Translation Lookaside Buffers (TLBs).

  To enable these features for a VM, you use the `VBoxManage modifyvm --vtx-vpid` and `VBoxManage modifyvm --large-pages` commands. See VBoxManage modifyvm.

11

Oracle VM VirtualBox Programming Interfaces

Oracle VM VirtualBox comes with comprehensive support for third-party developers. The so-called *Main API* of Oracle VM VirtualBox exposes the entire feature set of the virtualization engine. It is completely documented and available to anyone who wishes to control Oracle VM VirtualBox programmatically.

The Main API is made available to C++ clients through COM on Windows hosts or XPCOM on other hosts. Bridges also exist for SOAP, Java and Python.

All programming information such as documentation, reference information, header and other interface files, as well as samples have been split out to a separate **Software Development Kit (SDK)**. The SDK is available for download from http://www.virtualbox.org. In particular, the SDK comes with a Programming Guide and Reference manual in PDF format. This manual contains, among other things, the information that was previously in this chapter of the User Manual.

12

Troubleshooting

This chapter provides answers to commonly asked questions. In order to improve your user experience with Oracle VM VirtualBox, it is recommended to read this section to learn more about common pitfalls and get recommendations on how to use the product.

Procedures and Tools

Categorizing and Isolating Problems

More often than not, a virtualized guest behaves like a physical system. Any problems that a physical machine would encounter, a virtual machine will encounter as well. If, for example, Internet connectivity is lost due to external issues, virtual machines will be affected just as much as physical ones.

If a true Oracle VM VirtualBox problem is encountered, it helps to categorize and isolate the problem first. Here are some of the questions that should be answered before reporting a problem:

- Is the problem specific to a certain guest OS? Or a specific release of a guest OS? Especially with Linux guest related problems, the issue may be specific to a certain distribution and version of Linux.
- Is the problem specific to a certain host OS? Problems are usually not host OS specific, because most of the Oracle VM VirtualBox code base is shared across all supported platforms, but especially in the areas of networking and USB support, there are significant differences between host platforms. Some GUI related issues are also host specific.
- Is the problem specific to certain host hardware? This category of issues is typically related to the host CPU. Because of significant differences between VT-x and AMD-V, problems may be specific to one or the other technology. The exact CPU model may also make a difference because different CPUs support different features, which may affect certain aspects of guest CPU operation.
- Is the problem specific to guest SMP? That is, is it related to the number of virtual CPUs (VCPUs) in the guest? Using more than one CPU usually significantly affects the internal operation of a guest OS.
- Is the problem specific to the Guest Additions? In some cases, this is obvious, such as a shared folders problem. In other cases such as display problems, it may be less obvious. If the problem is Guest Additions specific, is it also specific to a certain version of the Guest Additions?
- Is the problem specific to a certain environment? Some problems are related to a particular environment external to the VM. This usually involves network setup. Certain configurations of external servers such as DHCP or PXE may expose problems which do not occur with other, similar servers.
- Is the problem a regression? Knowing that an issue is a regression usually makes it significantly easier to find the solution. In this case, it is crucial to know which version is affected and which is not.

Collecting Debugging Information

For problem determination, it is often important to collect debugging information which can be analyzed by Oracle VM VirtualBox support. This section contains information about what kind of information can be obtained.

Every time Oracle VM VirtualBox starts up a VM, a so-called *release log file* is created, containing lots of information about the VM configuration and runtime events. The log file is called `VBox.log` and resides in the VM log file folder, which is `$HOME/VirtualBox VMs/VM-name/Logs` by default.

When starting a VM, the configuration file of the last run will be renamed to `.1`, up to `.3`. Sometimes when there is a problem, it is useful to have a look at the logs. Also when requesting support for Oracle VM VirtualBox, supplying the corresponding log file is mandatory.

For convenience, for each virtual machine, VirtualBox Manager can show these logs in a window. Select a virtual machine from the machine list on the left and click **Logs** in the machine tools menu.

The release log file, `VBox.log`, contains a wealth of diagnostic information, such as Host OS type and version, Oracle VM VirtualBox version and build. It also includes a complete dump of the guest's configuration (CFGM), detailed information about the host CPU type and supported features, whether hardware virtualization is enabled, information about VT-x/AMD-V setup, state transitions (such as creating, running, paused, stopping), guest BIOS messages, Guest Additions messages, device-specific log entries and, at the end of execution, final guest state and condensed statistics.

In case of crashes, it is very important to collect *crash dumps*. This is true for both host and guest crashes. For information about enabling core dumps on Linux, Oracle Solaris, and macOS systems, refer to the following core dump article on the Oracle VM VirtualBox website:

http://www.virtualbox.org/wiki/Core_dump.

You can also use `VBoxManage debugvm` to create a dump of a complete virtual machine. See VBoxManage debugvm.

For network related problems, it is often helpful to capture a trace of network traffic. If the traffic is routed through an adapter on the host, it is possible to use Wireshark or a similar tool to capture the traffic there. However, this often also includes a lot of traffic unrelated to the VM.

Oracle VM VirtualBox provides an ability to capture network traffic only on a specific VM's network adapter. Refer to the following network tracing article on the Oracle VM VirtualBox website for information on enabling this capture:

http://www.virtualbox.org/wiki/Network_tips.

The trace files created by Oracle VM VirtualBox are in `.pcap` format and can be easily analyzed with Wireshark.

Using the VBoxBugReport Command to Collect Debug Information Automatically

The `VBoxBugReport` command is used to collect debug information automatically for an Oracle VM VirtualBox installation. This command can be useful when you need to gather information to send to Oracle Support.

The following examples show how to use `VBoxBugReport`.

By default, the command collects `VBoxSVC` process logs, device settings, and global configuration data for an Oracle VM VirtualBox host.

```
$ VBoxBugReport
  ...
  0% - collecting VBoxSVC.log.10...
  7% - collecting VBoxSVC.log.9...
  ...
 64% - collecting VBoxSVC.log.1...
 71% - collecting VBoxSVC.log...
 78% - collecting VirtualBox.xml...
 85% - collecting HostUsbDevices...
 92% - collecting HostUsbFilters...
100% - compressing...

Report was written to '2019-03-26-13-32-02-bugreport.tgz'
```

The results are saved as a compressed tar file archive in the same directory where the command is run.

To specify a different output file location:

```
$ VBoxBugReport --output ~/debug/bug004.tgz
```

To output all debug information to a single text file, rather than a `tgz` file:

```
$ VBoxBugReport --text
```

To collect information for a specific VM, called `Windows_10`:

```
$ VBoxBugReport Windows_10
```

This command collects machine settings, guest properties, and log files for the specified VM. Global configuration information for the host is also included.

To collect information for several VMs, called `Windows_7`, `Windows_8`, and `Windows_10`:

```
$ VBoxBugReport Windows_7 Windows_8 Windows_10
```

To collect information for all VMs:

```
$ VBoxBugReport --all
```

To show a full list of the available command options, run `VBoxBugReport --help`.

The Built-In VM Debugger

Oracle VM VirtualBox includes a built-in VM debugger, which advanced users may find useful. This debugger enables you to examine and, to some extent, control the VM state.

> **Caution:**
>
> Use the VM debugger at your own risk. There is no support for it, and the following documentation is only made available for advanced users with a very high level of familiarity with the x86/AMD64 machine instruction set, as well as detailed knowledge of the PC architecture. A degree of familiarity with the internals of the guest OS in question may also be very helpful.

The VM debugger is available in all regular production versions of Oracle VM VirtualBox, but it is disabled by default because the average user will have little use for it. There are two ways to access the debugger:

- Using a debugger console window displayed alongside the VM
- Using the `telnet` protocol on port 5000

The debugger can be enabled in the following ways:

- Start the VM directly using `VirtualBoxVM --startvm`, with an additional `--dbg`, `--debug`, or `--debug-command-line` argument. See the `VirtualBoxVM --help` command usage help for details.
- Set the `VBOX_GUI_DBG_ENABLED` or `VBOX_GUI_DBG_AUTO_SHOW` environment variable to `true` before launching the Oracle VM VirtualBox process. Setting these variables, only their presence is checked, is effective even when the first Oracle VM VirtualBox process is the VM selector window. VMs subsequently launched from the selector will have the debugger enabled.
- Set the `GUI/Dbg/Enabled` extra data item to `true` before launching the VM. This can be set globally or on a per VM basis.

A new **Debug** menu entry is added to the Oracle VM VirtualBox application. This menu enables the user to open the debugger console.

The VM debugger command syntax is loosely modeled on Microsoft and IBM debuggers used on DOS, OS/2, and Windows. Users familiar with symdeb, CodeView, or the OS/2 kernel debugger will find the Oracle VM VirtualBox VM debugger familiar.

The most important command is `help`. This will print brief usage help for all debugger commands. The set of commands supported by the VM debugger changes frequently and the `help` command is always up-to-date.

A brief summary of frequently used commands is as follows:

- `stop`: Stops the VM execution and enables single stepping
- `g`: Continue VM execution
- `t`: Single step an instruction
- `rg`, `rh`, and `r`: Print the guest, hypervisor, and current registers
- `kg`, `kh`, and `k`: Print the guest, hypervisor, and current call stack
- `da`, `db`, `dw`, `dd`, `dq`: Print memory contents as ASCII, bytes, words, dwords, and qwords
- `u`: Unassemble memory
- `dg`: Print the guest's GDT
- `di`: Print the guest's IDT
- `dl`: Print the guest's LDT
- `dt`: Print the guest's TSS
- `dp*`: Print the guest's page table structures
- `bp` and `br`: Set a normal and recompiler breakpoint
- `bl`: List breakpoints
- `bc`: Clear a breakpoint
- `writecore`: Write a VM core file to disk. See VM Core Format

See the built-in `help` for other available commands.

The VM debugger supports symbolic debugging, although symbols for guest code are often not available. For Oracle Solaris guests, the `detect` command automatically determines the guest OS version and locates kernel symbols in guest's memory. Symbolic debugging is then available. For Linux guests, the `detect` commands also determines the guest OS version, but there are no symbols in the guest's memory. Kernel symbols are available in the file `/proc/kallsyms` on Linux guests. This file must be copied to the host, for example using `scp`. The `loadmap` debugger command can be used to make the symbol information available to the VM debugger. Note that the `kallsyms` file contains the symbols for the currently loaded modules. If the guest's configuration changes, the symbols will change as well and must be updated.

For all guests, a simple way to verify that the correct symbols are loaded is the `k` command. The guest is normally idling and it should be clear from the symbolic information that the guest operating system's idle loop is being executed.

Another group of debugger commands is the set of `info` commands. Running `info help` provides complete usage information. The information commands provide ad-hoc data pertinent to various emulated devices and aspects of the VMM. There is no general guideline for using the `info` commands, the right command to use depends entirely on the problem being investigated. Some of the `info` commands are as follows:

- `cfgm`: Print a branch of the configuration tree
- `cpuid`: Display the guest CPUID leaves
- `ioport`: Print registered I/O port ranges
- `mmio`: Print registered MMIO ranges
- `mode`: Print the current paging mode
- `pit`: Print the i8254 PIT state
- `pic`: Print the i8259A PIC state
- `ohci`, `ehci`, `xhci`: Print a subset of the OHCI, EHCI, and xHCI USB controller state
- `pcnet0`: Print the PCnet state
- `vgatext`: Print the contents of the VGA framebuffer formatted as standard text mode
- `timers`: Print all VM timers

The output of the `info` commands generally requires in-depth knowledge of the emulated device or Oracle VM VirtualBox VMM internals. However, when used properly, the information provided can be invaluable.

VM Core Format

Oracle VM VirtualBox uses the 64-bit ELF format for its VM core files created by `VBoxManage debugvm`, see VBoxManage debugvm. The VM core file contain the memory and CPU dumps of the VM and can be useful for debugging your guest OS. The 64-bit ELF object format specification can be obtained at:

http://downloads.openwatcom.org/ftp/devel/docs/elf-64-gen.pdf.

The overall layout of the VM core format is as follows:

```
[ ELF 64 Header]
[ Program Header, type PT_NOTE ]
  → offset to COREDESCRIPTOR
```

```
[ Program Header, type PT_LOAD ] - one for each contiguous physical memory range
  → Memory offset of range
  → File offset
[ Note Header, type NT_VBOXCORE ]
[ COREDESCRIPTOR ]
  → Magic
  → VM core file version
  → VBox version
  → Number of vCPUs etc.
[ Note Header, type NT_VBOXCPU ] - one for each vCPU
[ vCPU 1 Note Header ]
  [ DBGFCORECPU - vCPU 1 dump ]
[ Additional Notes + Data ] - currently unused
[ Memory dump ]
```

The memory descriptors contain physical addresses relative to the guest and not virtual addresses. Regions of memory such as MMIO regions are not included in the core file.

The relevant data structures and definitions can be found in the Oracle VM VirtualBox sources under the following header files: `include/VBox/dbgfcorefmt.h`, `include/iprt/x86.h` and `src/VBox/Runtime/include/internal/ldrELFCommon.h`.

The VM core file can be inspected using `elfdump` and GNU `readelf` or other similar utilities.

General Troubleshooting

Guest Shows IDE/SATA Errors for File-Based Images on Slow Host File System

Occasionally, some host file systems provide very poor writing performance and as a consequence cause the guest to time out IDE/SATA commands. This is normal behavior and should normally cause no real problems, as the guest should repeat commands that have timed out. However, guests such as some Linux versions have severe problems if a write to an image file takes longer than about 15 seconds. Some file systems however require more than a minute to complete a single write, if the host cache contains a large amount of data that needs to be written.

The symptom for this problem is that the guest can no longer access its files during large write or copying operations, usually leading to an immediate hang of the guest.

In order to work around this problem, the true fix is to use a faster file system that does not exhibit such unacceptable write performance, it is possible to flush the image file after a certain amount of data has been written. This interval is normally infinite, but can be configured individually for each disk of a VM.

For IDE disks use the following command:

```
VBoxManage setextradata VM-name
"VBoxInternal/Devices/piix3ide/0/LUN#[x]/Config/FlushInterval" [b]
```

For SATA disks use the following command:

```
VBoxManage setextradata VM-name
"VBoxInternal/Devices/ahci/0/LUN#[x]/Config/FlushInterval" [b]
```

`[x]` specifies the disk. For IDE, `0` represents device 0 on the primary channel, `1` represents device 1 on the primary channel, `2` represents device 0 on the secondary channel, and `3`

represents device 1 on the secondary channel. For SATA, use values between `0` and `29`. This configuration option applies to disks only. Do not use this option for CD or DVD drives.

The unit of the interval (`[b]`) is the number of bytes written since the last flush. The value for it must be selected so that the occasional long write delays do not occur. Since the proper flush interval depends on the performance of the host and the host filesystem, finding the optimal value that makes the problem disappear requires some experimentation. Values between 1000000 and 10000000 (1 to 10 megabytes) are a good starting point. Decreasing the interval both decreases the probability of the problem and the write performance of the guest. Setting the value unnecessarily low will cost performance without providing any benefits. An interval of 1 will cause a flush for each write operation and should solve the problem in any case, but has a severe write performance penalty.

Providing a value of `0` for `[b]` is treated as an infinite flush interval, effectively disabling this workaround. Removing the extra data key by specifying no value for `[b]` has the same effect.

Responding to Guest IDE/SATA Flush Requests

If desired, the virtual disk images can be flushed when the guest issues the IDE FLUSH CACHE command. Normally these requests are ignored for improved performance. The parameters below are only accepted for disk drives. They must not be set for DVD drives.

To enable flushing for IDE disks, issue the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/Devices/piix3ide/0/LUN#[x]/Config/
IgnoreFlush" 0
```

`[x]` specifies the disk. Enter `0` for device 0 on the primary channel, `1` for device 1 on the primary channel, `2` for device 0 on the secondary channel, or `3` for device 1 on the secondary channel.

To enable flushing for SATA disks, issue the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/Devices/ahci/0/LUN#[x]/Config/
IgnoreFlush" 0
```

The value [x] that selects the disk can be a value between 0 and 29.

Note that this does not affect the flushes performed according to the configuration described in Guest Shows IDE/SATA Errors for File-Based Images on Slow Host File System. Restoring the default of ignoring flush commands is possible by setting the value to 1 or by removing the key.

Performance Variation with Frequency Boosting

Many multicore processors support some form of frequency boosting, which means that if only one core is utilized, it can run possibly 50% faster or even more than the rated CPU frequency. This causes measured performance to vary somewhat as a function of the momentary overall system load. The exact behavior depends strongly on the specific processor model.

As a consequence, benchmarking on systems which utilize frequency boosting may produce unstable and non-repeatable results. This is especially true if benchmark runs are short, of the order of seconds. To obtain stable results, benchmarks must be run over longer periods of time and with a constant system load apart from the VM being tested.

Frequency Scaling Effect on CPU Usage

On some hardware platforms and operating systems, CPU frequency scaling may cause CPU usage reporting to be highly misleading. This happens in situations when the host CPU load is significant but not heavy, such as between 15% to 30% of the maximum.

Most operating systems determine CPU usage in terms of time spent, measuring for example how many nanoseconds the systems or a process was active within one second. However, in order to save energy, systems can significantly scale down CPU speed when the system is not fully loaded. When the CPU is running at for example one half of its maximum speed, the same number of instructions will take roughly twice as long to execute compared to running at full speed.

Depending on the specific hardware and host OS, this effect can very significantly skew the CPU usage reported by the OS. The reported CPU usage can be several times higher than what it would have been had the CPU been running at full speed. The effect can be observed both on the host OS and in a guest OS.

Inaccurate Windows CPU Usage Reporting

CPU usage reporting tools which come with Windows, such as Task Manager or Resource Monitor, do not take the time spent processing hardware interrupts into account. If the interrupt load is heavy, with thousands of interrupts per second, CPU usage may be significantly underreported.

This problem affects Windows as both host and guest OS. Sysinternals tools, such as Process Explorer, do not suffer from this problem.

Poor Performance Caused by Host Power Management

On some hardware platforms and operating systems, virtualization performance is negatively affected by host CPU power management. The symptoms may be choppy audio in the guest or erratic guest clock behavior.

Some of the problems may be caused by firmware and/or host operating system bugs. Therefore, updating the firmware and applying operating systems fixes is recommended.

For optimal virtualization performance, the C1E power state support in the system's BIOS should be disabled, if such a setting is available. Not all systems support the C1E power state. On Intel systems, the `Intel C State` setting should be disabled. Disabling other power management settings may also improve performance. However, a balance between performance and power consumption must always be considered.

GUI: 2D Video Acceleration Option is Grayed Out

To use 2D Video Acceleration within Oracle VM VirtualBox, your host's video card should support certain OpenGL extensions. On startup, Oracle VM VirtualBox checks for those extensions, and, if the test fails, this option is silently grayed out.

To find out why it has failed, you can manually execute the following command:

```
$ VBoxTestOGL --log "log_file_name" --test 2D
```

It will list the required OpenGL extensions one by one and will show you which one failed the test. This usually means that you are running an outdated or misconfigured OpenGL driver on your host. It can also mean that your video chip is lacking required functionality.

Windows Guests

No USB 3.0 Support in Windows 7 Guests

If a Windows 7 or Windows Server 2008 R2 guest is configured for USB 3.0 (xHCI) support, the guest OS will not have any USB support at all. This happens because Windows 7 predates USB 3.0 and therefore does not ship with any xHCI drivers. Microsoft also does not offer any vendor-provided xHCI drivers through Windows Update.

To solve this problem, it is necessary to download and install the Intel xHCI driver in the guest. Intel offers the driver as the USB 3.0 eXtensible Host Controller (xHCI) driver for Intel 7 Series/C216 chipsets.

Note that the driver only supports Windows 7 and Windows Server 2008 R2. The driver package includes support for both 32-bit and 64-bit OS variants.

Windows Bluescreens After Changing VM Configuration

Changing certain virtual machine settings can cause Windows guests to fail during start up with a bluescreen. This may happen if you change VM settings after installing Windows, or if you copy a disk image with an already installed Windows to a newly created VM which has settings that differ from the original machine.

This applies in particular to the following settings:

- The ACPI and I/O APIC settings should never be changed after installing Windows. Depending on the presence of these hardware features, the Windows installation program chooses special kernel and device driver versions and will fail to startup should these hardware features be removed. Enabling them for a Windows VM which was installed without them does not cause any harm. However, Windows will not use these features in this case.
- Changing the storage controller hardware will cause bootup failures as well. This might also apply to you if you copy a disk image from an older version of Oracle VM VirtualBox to a new virtual machine. The default subtype of IDE controller hardware used by Oracle VM VirtualBox is PIIX4. Make sure that the storage controller settings are identical.

Windows 0x101 Bluescreens with SMP Enabled (IPI Timeout)

If a VM is configured to have more than one processor (symmetrical multiprocessing, SMP), some configurations of Windows guests crash with an 0x101 error message, indicating a timeout for interprocessor interrupts (IPIs). These interrupts synchronize memory management between processors.

According to Microsoft, this is due to a race condition in Windows. A hotfix is available from Microsoft.

If this does not help, please reduce the number of virtual processors to 1.

Windows 2000 Installation Failures

When installing Windows 2000 guests, you might run into one of the following issues:

- Installation reboots, usually during component registration.
- Installation fills the whole hard disk with empty log files.

- Installation complains about a failure installing `msgina.dll`.

These problems are all caused by a bug in the hard disk driver of Windows 2000. After issuing a hard disk request, there is a race condition in the Windows driver code which leads to corruption if the operation completes too fast. For example, the hardware interrupt from the IDE controller arrives too soon. With physical hardware, there is a guaranteed delay in most systems so the problem is usually hidden there. However, it should be possible to also reproduce it on physical hardware. In a virtual environment, it is possible for the operation to be done immediately, especially on very fast systems with multiple CPUs, and the interrupt is signaled sooner than on a physical system. The solution is to introduce an artificial delay before delivering such interrupts. This delay can be configured for a VM using the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/Devices/piix3ide/0/Config/IRQDelay" 1
```

This sets the delay to one millisecond. In case this does not help, increase it to a value between 1 and 5 milliseconds. Please note that this slows down disk performance. After installation, you should be able to remove the key, or set it to 0.

How to Record Bluescreen Information from Windows Guests

When Windows guests run into a kernel crash, they display a bluescreen error. Depending on how Windows is configured, the information will remain on the screen until the machine is restarted or it will reboot automatically. During installation, Windows is usually configured to reboot automatically. With automatic reboots, there is no chance to record the bluescreen information which might be important for problem determination.

Oracle VM VirtualBox provides a method of halting a guest when it wants to perform a reset. In order to enable this feature, use the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/PDM/HaltOnReset" 1
```

No Networking in Windows Vista Guests

With Windows Vista, Microsoft dropped support for the AMD PCNet card that legacy versions of Oracle VM VirtualBox used to provide as the default virtual network card. For Windows Vista guests, Oracle VM VirtualBox now uses an Intel E1000 card by default.

If, for some reason, you still want to use the AMD card, you need to download the PCNet driver from the AMD website. This driver is available for 32-bit Windows only. You can transfer it into the virtual machine using a shared folder. See Shared Folders.

Windows Guests may Cause a High CPU Load

Several background applications of Windows guests, especially virus scanners, are known to increase the CPU load notably even if the guest appears to be idle. We recommend to deactivate virus scanners within virtualized guests if possible.

Long Delays When Accessing Shared Folders

The performance for accesses to shared folders from a Windows guest might be decreased due to delays during the resolution of the Oracle VM VirtualBox shared folders name service. To fix these delays, add the following entries to the file `\windows\system32\drivers\etc\lmhosts` of the Windows guest:

```
255.255.255.255        VBOXSVR #PRE
255.255.255.255        VBOXSRV #PRE
```

After doing this change, a reboot of the guest is required.

USB Tablet Coordinates Wrong in Windows 98 Guests

If a Windows 98 VM is configured to use the emulated USB tablet (absolute pointing device), the coordinate translation may be incorrect and the pointer is restricted to the upper left quarter of the guest's screen.

The USB HID (Human Interface Device) drivers in Windows 98 are very old and do not handle tablets in the same way as modern operating systems do. To work around the problem, use the following command:

```
$ VBoxManage setextradata VM-name "VBoxInternal/USB/HidMouse/0/Config/CoordShift" 0
```

To restore the default behavior, remove the key or set its value to 1.

Windows Guests are Removed From an Active Directory Domain After Restoring a Snapshot

If a Windows guest is a member of an Active Directory domain and the snapshot feature of Oracle VM VirtualBox is used, it could be removed from the Active Direcory domain after you restore an older snapshot.

This is caused by automatic machine password changes performed by Windows at regular intervals for security purposes. You can disable this feature as shown in the following article from Microsoft: http://support.microsoft.com/kb/154501.

Windows 3.x Limited to 64 MB RAM

Windows 3.x guests are typically limited to 64 MB RAM, even if a VM is assigned much more memory. While Windows 3.1 is theoretically capable of using up to 512 MB RAM, it only uses memory available through the XMS interface. Versions of HIMEM.SYS, the Microsoft XMS manager, shipped with MS-DOS and Microsoft Windows 3.x can only use up to 64 MB on standard PCs.

This is a known HIMEM.SYS limitation. Windows 3.1 memory limits are described in detail in Microsoft Knowledge base article KB 84388.

It is possible for Windows 3.x guests to utilize more than 64 MB RAM if a different XMS provider is used. That could be a newer HIMEM.SYS version, such as that shipped with Windows 98, or a more capable third-party memory manager, such as QEMM.

Linux and X11 Guests

Linux Guests May Cause a High CPU load

Some Linux guests may cause a high CPU load even if the guest system appears to be idle. This can be caused by a high timer frequency of the guest kernel. Some Linux distributions, for example Fedora, ship a Linux kernel configured for a timer frequency of 1000Hz. We recommend to recompile the guest kernel and to select a timer frequency of 100Hz.

Linux kernels shipped with Red Hat Enterprise Linux, as well as kernels of related Linux distributions, such as CentOS and Oracle Linux, support a kernel parameter *divider=N*. Hence, such kernels support a lower timer frequency without recompilation. We suggest you add the kernel parameter *divider=10* to select a guest kernel timer frequency of 100Hz.

Buggy Linux 2.6 Kernel Versions

The following bugs in Linux kernels prevent them from executing correctly in Oracle VM VirtualBox, causing VM boot crashes:

- The Linux kernel version 2.6.18, and some 2.6.17 versions, introduced a race condition that can cause boot crashes in Oracle VM VirtualBox. Please use a kernel version 2.6.19 or later.
- With hardware virtualization and the I/O APIC enabled, kernels before 2.6.24-rc6 may panic on boot with the following message:

  ```
  Kernel panic - not syncing: IO-APIC + timer doesn't work!  Boot with
  apic=debug and send a report.  Then try booting with the 'noapic' option
  ```

  If you see this message, either disable hardware virtualization or the I/O APIC as described in System Settings, or upgrade the guest to a newer kernel.

  See http://www.mail-archive.com/git-commits-head@vger.kernel.org/msg30813.html for details about the kernel fix.

Shared Clipboard, Auto-Resizing, and Seamless Desktop in X11 Guests

Guest desktop services in guests running the X11 window system such as Oracle Solaris and Linux, are provided by a guest service called `VBoxClient`, which runs under the ID of the user who started the desktop session and is automatically started using the following command lines when your X11 user session is started if you are using a common desktop environment such as Gnome or KDE.

```
$ VBoxClient --clipboard
$ VBoxClient --display
$ VBoxClient --seamless
```

If a particular desktop service is not working correctly, it is worth checking whether the process which should provide it is running.

The `VBoxClient` processes create files in the user's home directory with names of the form `.vboxclient-*.pid` when they are running in order to prevent a given service from being started twice. It can happen due to misconfiguration that these files are created owned by root and not deleted when the services are stopped, which will prevent them from being started in future sessions. If the services cannot be started, you may wish to check whether these files still exist.

Oracle Solaris Guests

Certain Oracle Solaris 10 Releases May Take a Long Time to Boot with SMP

When using more than one CPU, Oracle Solaris 10 10/08, and Oracle Solaris 10 5/09 may take a long time to boot and may print warnings on the system console regarding failures to read from disk. This is a bug in Oracle Solaris 10 which affects specific physical and virtual configurations. It is caused by trying to read microcode updates from the boot disk when the disk interrupt is reassigned to a not yet fully initialized secondary CPU. Disk reads will time out and fail, triggering delays of about 45 seconds and warnings.

The recommended solution is upgrading to at least Oracle Solaris 10 10/09 which includes a fix for this problem. Alternative solutions include restricting the number of virtual CPUs to one or possibly using a different storage controller.

Older Solaris Releases Do Not Work with E1000 Ethernet

Solaris releases before Solaris 10 1/06, including Solaris 9, Solaris 10 1/05 (GA), and Solaris 10 3/05 (HW2), are unable to communicate through the Intel E1000 card. The Solaris e1000g driver does not enable PCI bus mastering for the network adapter and is therefore unable to send and receive data. This problem appears to be specific to the e1000g driver and does not reflect general Solaris driver behavior.

The AMD PCnet emulation (using the Solaris pcn driver) can be used instead of Intel E1000. Solaris 10 1/06 (U1) and later releases do not have this problem and work with the emulated E1000 ethernet controller.

Windows Hosts

Drag'n Drop not Working

Microsoft Windows uses technologies like UAC (User Account Control) and UIPI (User Interface Privilege Isolation) to prevent and/or mitigate security issues. By default, UAC and UIPI are enabled.

When an Oracle VM VirtualBox VM process is running with a higher so-called privilege level than another process that wants to interact with the VM process via drag'n drop (or system clipboard), Windows prevents this by default due to security reasons. This results in Oracle VM VirtualBox not being able to receive any Windows messages for drag'n drop. To make this work, the Oracle VM VirtualBox VM process must be running with the same (or lower) privilege level as the process it is interacting with using drag'n drop.

Disabling UAC and/or UIPI is not recommended.

VBoxSVC Out-of-Process COM Server Issues

Oracle VM VirtualBox makes use of the Microsoft Component Object Model (COM) for interprocess and intraprocess communication. This enables Oracle VM VirtualBox to share a common configuration among different virtual machine processes and provide several user interface options based on a common architecture. All global status information and configuration is maintained by the process `VBoxSVC.exe`, which is an out-of-process COM server. Whenever an Oracle VM VirtualBox process is started, it requests access to the COM server and Windows automatically starts the process. Note that it should never be started by the end user.

When the last process disconnects from the COM server, it will terminate itself after some seconds. The Oracle VM VirtualBox configuration XML files are maintained and owned by the COM server and the files are locked whenever the server runs.

In some cases, such as when a virtual machine is terminated unexpectedly, the COM server will not notice that the client is disconnected and stay active for a longer period of 10 minutes or so, keeping the configuration files locked. In other rare cases the COM server might experience an internal error and subsequently other processes fail to initialize it. In these situations, it is recommended to use the Windows task manager to kill the process `VBoxSVC.exe`.

CD and DVD Changes Not Recognized

In case you have assigned a physical CD or DVD drive to a guest and the guest does not notice when the medium changes, make sure that the Windows media change notification (MCN) feature is not turned off. This is represented by the following key in the Windows registry:

```
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Cdrom\Autorun
```

Certain applications may disable this key against Microsoft's advice. If it is set to 0, change it to 1 and reboot your system. Oracle VM VirtualBox relies on Windows notifying it of media changes.

Sluggish Response When Using Microsoft RDP Client

If connecting to a Virtual Machine using the Microsoft RDP client, called a Remote Desktop Connection, there can be large delays between input such as moving the mouse over a menu and output. This is because this RDP client collects input for a certain time before sending it to the RDP server.

The interval can be decreased by setting a Windows registry key to smaller values than the default of 100. The key does not exist initially and must be of type DWORD. The unit for its values is milliseconds. Values around 20 are suitable for low-bandwidth connections between the RDP client and server. Values around 4 can be used for a gigabit Ethernet connection. Generally values below 10 achieve a performance that is very close to that of the local input devices and screen of the host on which the Virtual Machine is running.

Depending whether the setting should be changed for an individual user or for the system, set either of the following.

```
HKEY_CURRENT_USER\Software\Microsoft\Terminal Server Client\Min Send Interval
```

```
HKEY_LOCAL_MACHINE\Software\Microsoft\Terminal Server Client\Min Send Interval
```

Running an iSCSI Initiator and Target on a Single System

Deadlocks can occur on a Windows host when attempting to access an iSCSI target running in a guest virtual machine with an iSCSI initiator, such as a Microsoft iSCSI Initiator, that is running on the host. This is caused by a flaw in the Windows cache manager component, and causes sluggish host system response for several minutes, followed by a "Delayed Write Failed" error message in the system tray or in a separate message window. The guest is blocked during that period and may show error messages or become unstable.

Setting the `VBOX_DISABLE_HOST_DISK_CACHE` environment variable to `1` enables a workaround for this problem until Microsoft addresses the issue. For example, open a command prompt window and start Oracle VM VirtualBox like this:

```
set VBOX_DISABLE_HOST_DISK_CACHE=1
VirtualBox
```

While this will decrease guest disk performance, especially writes, it does not affect the performance of other applications running on the host.

Bridged Networking Adapters Missing

If no bridged adapters show up in the **Networking** section of the VM settings, this typically means that the bridged networking driver was not installed properly on your host. This could be due to the following reasons:

- The maximum allowed filter count was reached on the host. In this case, the MSI log would mention the `0x8004a029` error code returned on NetFlt network component install, as follows:

  ```
  VBoxNetCfgWinInstallComponent: Install failed, hr (0x8004a029)
  ```

  You can try to increase the maximum filter count in the Windows registry using the following key:

  ```
  HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Network\MaxNumFilters
  ```

  The maximum number allowed is 14. After a reboot, try to reinstall Oracle VM VirtualBox.

- The INF cache is corrupt. In this case, the install log at `%windir%\inf\setupapi.dev.log` would typically mention the failure to find a suitable driver package for either the `sun_VBoxNetFlt` or `sun_VBoxNetFltmp` components. The solution then is to uninstall Oracle VM VirtualBox, remove the INF cache (`%windir%\inf\INFCACHE.1`), reboot and try to reinstall Oracle VM VirtualBox.

Host-Only Networking Adapters Cannot be Created

If a host-only adapter cannot be created, either with the VirtualBox Manager or the `VBoxManage` command, then the INF cache is probably corrupt. In this case, the install log at `%windir%\inf\setupapi.dev.log` would typically mention the failure to find a suitable driver package for the `sun_VBoxNetAdp` component. Again, as with the bridged networking problem described above, the solution is to uninstall Oracle VM VirtualBox, remove the INF cache (`%windir%\inf\INFCACHE.1`), reboot and try to reinstall Oracle VM VirtualBox.

Linux Hosts

Linux Kernel Module Refuses to Load

If the Oracle VM VirtualBox kernel module, `vboxdrv`, refuses to load you may see an `Error inserting vboxdrv: Invalid argument` message. As root, check the output of the `dmesg` command to find out why the load failed. Most probably the kernel disagrees with the version of `gcc` used to compile the module. Make sure that you use the same compiler that was used to build the kernel.

Linux Host CD/DVD or Floppy Disk Drive Not Found

If you have configured a virtual machine to use the host's CD or DVD drive or floppy disk drive, but this does not appear to work, make sure that the current user has permission to access the corresponding Linux device file. For example, for a CD or DVD drive this may be `/dev/hdc`, `/dev/scd0`, `/dev/cdrom` or similar. On most distributions, the user must be added to a corresponding group, usually called `cdrom` or `cdrw` or `floppy`.

On supported Linux distributions, Oracle VM VirtualBox uses `udev` to locate hardware such as CD/DVD drives and floppy disk drives.

Strange Guest IDE Error Messages When Writing to CD or DVD

If the experimental CD or DVD writer support is enabled with an incorrect host or guest configuration, it is possible that any attempt to access the CD or DVD writer fails and simply results in guest kernel error messages for Linux guests or application error messages for Windows guests. Oracle VM VirtualBox performs the usual consistency checks when a VM is powered up. In particular, it aborts with an error message if the device for the CD or DVD writer is not writable by the user starting the VM. But Oracle VM VirtualBox cannot detect all misconfigurations. The necessary host and guest OS configuration is not specific for Oracle VM VirtualBox, but a few frequent problems are listed here which occurred in connection with Oracle VM VirtualBox.

Special care must be taken to use the correct device. The configured host CD or DVD device file name, in most cases `/dev/cdrom`, must point to the device that allows writing to the CD or DVD unit. For CD or DVD writer units connected to a SCSI controller or to a IDE controller that interfaces to the Linux SCSI subsystem, common for some SATA controllers, this must refer to the SCSI device node, such as `/dev/scd0`. Even for IDE CD or DVD writer units this must refer to the appropriate SCSI CD-ROM device node, such as `/dev/scd0`, if the `ide-scsi` kernel module is loaded. This module is required for CD or DVD writer support with some early 2.6 kernels. Many Linux distributions load this module whenever a CD or DVD writer is detected in the system, even if the kernel would support CD or DVD writers without the module. Oracle VM VirtualBox supports the use of IDE device files, such as `/dev/hdc`, provided the kernel supports this and the `ide-scsi` module is not loaded.

Similar rules, except that within the guest the CD or DVD writer is always an IDE device, apply to the guest configuration. Since this setup is very common, it is likely that the default configuration of the guest works as expected.

VBoxSVC IPC Issues

On Linux, Oracle VM VirtualBox makes use of a custom version of Mozilla XPCOM (cross platform component object model) for interprocess and intraprocess communication (IPC). The process `VBoxSVC` serves as a communication hub between different Oracle VM VirtualBox processes and maintains the global configuration, such as the XML database. When starting an Oracle VM VirtualBox component, the processes `VBoxSVC` and `VBoxXPCOMIPCD` are started automatically. They are only accessible from the user account they are running under. `VBoxSVC` owns the Oracle VM VirtualBox configuration database which normally resides in `~/.config/VirtualBox`, or the appropriate configuration directory for your operating system. While it is running, the configuration files are locked. Communication between the various Oracle VM VirtualBox components and `VBoxSVC` is performed through a local domain socket residing in `/tmp/.vbox-`*`username`*`-ipc`. In case there are communication problems, such as an Oracle VM VirtualBox application cannot communicate with `VBoxSVC`, terminate the daemons and remove the local domain socket directory.

USB Not Working

If USB is not working on your Linux host, make sure that the current user is a member of the `vboxusers` group. Please keep in mind that group membership does not take effect immediately but rather at the next login. If available, the `newgrp` command may avoid the need for a logout and login.

PAX/grsec Kernels

Linux kernels including the grsec patch, see http://www.grsecurity.net/, and derivates have to disable PAX_MPROTECT for the `VBox` binaries to be able to start a VM. The reason is that Oracle VM VirtualBox has to create executable code on anonymous memory.

Linux Kernel vmalloc Pool Exhausted

When running a large number of VMs with a lot of RAM on a Linux system, say 20 VMs with 1 GB of RAM each, additional VMs might fail to start with a kernel error saying that the vmalloc pool is exhausted and should be extended. The error message also tells you to specify `vmalloc=256MB` in your kernel parameter list. If adding this parameter to your GRUB or LILO configuration makes the kernel fail to boot, with an error message such as `failed to mount the root partition`, then you have probably run into a memory conflict of your kernel and initial RAM disk. This can be solved by adding the following parameter to your GRUB configuration:

```
uppermem 524288
```

Oracle Solaris Hosts

Cannot Start VM, Not Enough Contiguous Memory

The ZFS file system is known to use nearly all available RAM as cache if the default system settings are not changed. This may lead to a heavy fragmentation of the host memory preventing Oracle VM VirtualBox VMs from being started. We recommend to limit the ZFS cache by adding the following line to `/etc/system`, where *xxxx* bytes is the amount of memory usable for the ZFS cache.

```
set zfs:zfs_arc_max = xxxx
```

13

Security Guide

General Security Principles

The following principles are fundamental to using any application securely.

- **Keep software up to date**. One of the principles of good security practise is to keep all software versions and patches up to date. Activate the Oracle VM VirtualBox update notification to get notified when a new Oracle VM VirtualBox release is available. When updating Oracle VM VirtualBox, do not forget to update the Guest Additions. Keep the host operating system as well as the guest operating system up to date.
- **Restrict network access to critical services.** Use proper means, for instance a firewall, to protect your computer and your guests from accesses from the outside. Choosing the proper networking mode for VMs helps to separate host networking from the guest and vice versa.
- **Follow the principle of least privilege.** The principle of least privilege states that users should be given the least amount of privilege necessary to perform their jobs. Always execute Oracle VM VirtualBox as a regular user. We strongly discourage anyone from executing Oracle VM VirtualBox with system privileges.

  Choose restrictive permissions when creating configuration files, for instance when creating /etc/default/virtualbox, see Automatic Installation Options. Mode 0600 is preferred.
- **Monitor system activity.** System security builds on three pillars: good security protocols, proper system configuration and system monitoring. Auditing and reviewing audit records address the third requirement. Each component within a system has some degree of monitoring capability. Follow audit advice in this document and regularly monitor audit records.
- **Keep up to date on latest security information.** Oracle continually improves its software and documentation. Check this note yearly for revisions.

Secure Installation and Configuration

Installation Overview

The Oracle VM VirtualBox base package should be downloaded only from a trusted source, for instance the official website http://www.virtualbox.org. The integrity of the package should be verified with the provided SHA256 checksum which can be found on the official website.

General Oracle VM VirtualBox installation instructions for the supported hosts can be found in Installation Details.

On Windows hosts, the installer can be used to disable USB support, support for bridged networking, support for host-only networking and the Python language binding. See Installing on Windows Hosts. All these features are enabled by default but disabling some of them could be appropriate if the corresponding functionality is not required by any virtual machine. The Python language bindings are only required if the Oracle VM VirtualBox API is to be used by external Python applications. In particular USB support and support for the two networking

modes require the installation of Windows kernel drivers on the host. Therefore disabling those selected features can not only be used to restrict the user to certain functionality but also to minimize the surface provided to a potential attacker.

The general case is to install the complete Oracle VM VirtualBox package. The installation must be done with system privileges. All Oracle VM VirtualBox binaries should be executed as a regular user and never as a privileged user.

The Oracle VM VirtualBox Extension Pack provides additional features and must be downloaded and installed separately, see Installing Oracle VM VirtualBox and Extension Packs. As for the base package, the SHA256 checksum of the extension pack should be verified. As the installation requires system privileges, Oracle VM VirtualBox will ask for the system password during the installation of the extension pack.

Post Installation Configuration

Normally there is no post installation configuration of Oracle VM VirtualBox components required. However, on Oracle Solaris and Linux hosts it is necessary to configure the proper permissions for users executing VMs and who should be able to access certain host resources. For instance, Linux users must be member of the *vboxusers* group to be able to pass USB devices to a guest. If a serial host interface should be accessed from a VM, the proper permissions must be granted to the user to be able to access that device. The same applies to other resources like raw partitions, DVD/CD drives, and sound devices.

Security Features

This section outlines the specific security mechanisms offered by Oracle VM VirtualBox.

The Security Model

One property of virtual machine monitors (VMMs) like Oracle VM VirtualBox is to encapsulate a guest by executing it in a protected environment, a virtual machine, running as a user process on the host operating system. The guest cannot communicate directly with the hardware or other computers but only through the VMM. The VMM provides emulated physical resources and devices to the guest which are accessed by the guest operating system to perform the required tasks. The VM settings control the resources provided to the guest, for example the amount of guest memory or the number of guest processors and the enabled features for that guest. For example remote control, certain screen settings and others. See General Settings.

Secure Configuration of Virtual Machines

Several aspects of a virtual machine configuration are subject to security considerations.

Networking

The default networking mode for VMs is NAT which means that the VM acts like a computer behind a router, see Network Address Translation (NAT). The guest is part of a private subnet belonging to this VM and the guest IP is not visible from the outside. This networking mode works without any additional setup and is sufficient for many purposes. Keep in mind that NAT allows access to the host operating system's loopback interface.

If bridged networking is used, the VM acts like a computer inside the same network as the host, see Bridged Networking. In this case, the guest has the same network access as the host and a firewall might be necessary to protect other computers on the subnet from a potential malicious guest as well as to protect the guest from a direct access from other computers. In

some cases it is worth considering using a forwarding rule for a specific port in NAT mode instead of using bridged networking.

Some setups do not require a VM to be connected to the public network at all. Internal networking, see Internal Networking, or host-only networking, see Host-Only Networking, are often sufficient to connect VMs among each other or to connect VMs only with the host but not with the public network.

VRDP Remote Desktop Authentication

When using the Oracle VM VirtualBox Extension Pack provided by Oracle for VRDP remote desktop support, you can optionally use various methods to configure RDP authentication. The "null" method is very insecure and should be avoided in a public network. See RDP Authentication.

Clipboard

The shared clipboard enables users to share data between the host and the guest. Enabling the clipboard in Bidirectional mode enables the guest to read and write the host clipboard. The Host to Guest mode and the Guest to Host mode limit the access to one direction. If the guest is able to access the host clipboard it can also potentially access sensitive data from the host which is shared over the clipboard.

If the guest is able to read from and/or write to the host clipboard then a remote user connecting to the guest over the network will also gain this ability, which may not be desirable. As a consequence, the shared clipboard is disabled for new machines.

Shared Folders

If any host folder is shared with the guest then a remote user connected to the guest over the network can access these files too as the folder sharing mechanism cannot be selectively disabled for remote users.

3D Graphics Acceleration

Enabling 3D graphics using the Guest Additions exposes the host to additional security risks. See Hardware 3D Acceleration (OpenGL and Direct3D 8/9).

CD/DVD Passthrough

Enabling CD/DVD passthrough enables the guest to perform advanced operations on the CD/DVD drive, see CD/DVD Support. This could induce a security risk as a guest could overwrite data on a CD/DVD medium.

USB Passthrough

Passing USB devices to the guest provides the guest full access to these devices, see USB Settings. For instance, in addition to reading and writing the content of the partitions of an external USB disk the guest will be also able to read and write the partition table and hardware data of that disk.

Configuring and Using Authentication

The following components of Oracle VM VirtualBox can use passwords for authentication:

- When using remote iSCSI storage and the storage server requires authentication, an initiator secret can optionally be supplied with the `VBoxManage storageattach` command. As long as no settings password is provided, by using the command line option `--settingspwfile`, then this secret is stored *unencrypted* in the machine configuration and is therefore potentially readable on the host. See iSCSI Servers and VBoxManage storageattach.
- When using the Oracle VM VirtualBox web service to control an Oracle VM VirtualBox host remotely, connections to the web service are authenticated in various ways. This is described in detail in the Oracle VM VirtualBox Software Development Kit (SDK) reference. See Oracle VM VirtualBox Programming Interfaces.

Potentially Insecure Operations

The following features of Oracle VM VirtualBox can present security problems:

- Enabling 3D graphics using the Guest Additions exposes the host to additional security risks. See Hardware 3D Acceleration (OpenGL and Direct3D 8/9).
- When teleporting a machine, the data stream through which the machine's memory contents are transferred from one host to another is not encrypted. A third party with access to the network through which the data is transferred could therefore intercept that data. An SSH tunnel could be used to secure the connection between the two hosts. But when considering teleporting a VM over an untrusted network the first question to answer is how both VMs can securely access the same virtual disk image with a reasonable performance.

  If the network is not sufficiently trusted, the password should be changed for each teleportation as a third party could detect the unecrypted password hash when it is transferred between the target and source host machines.
- When Page Fusion, is enabled, it is possible that a side-channel opens up that enables a malicious guest to determine the address space of another VM running on the same host layout. For example, where DLLs are typically loaded. This information leak in itself is harmless, however the malicious guest may use it to optimize attack against that VM through unrelated attack vectors. It is recommended to only enable Page Fusion if you do not think this is a concern in your setup.
- When using the Oracle VM VirtualBox web service to control an Oracle VM VirtualBox host remotely, connections to the web service, over which the API calls are transferred using SOAP XML, are not encrypted. They use plain HTTP by default. This is a potential security risk. For details about the web service, see Oracle VM VirtualBox Programming Interfaces.

  The web services are not started by default. See Starting the Oracle VM VirtualBox Web Service Automatically to find out how to start this service and how to enable SSL/TLS support. It has to be started as a regular user and only the VMs of that user can be controlled. By default, the service binds to localhost preventing any remote connection.
- Traffic sent over a UDP Tunnel network attachment is not encrypted. You can either encrypt it on the host network level, with IPsec, or use encrypted protocols in the guest network, such as SSH. The security properties are similar to bridged Ethernet.
- Because of shortcomings in older Windows versions, using Oracle VM VirtualBox on Windows versions older than Vista with Service Pack 1 is not recommended.

Encryption

The following components of Oracle VM VirtualBox use encryption to protect sensitive data:

- When using the Oracle VM VirtualBox Extension Pack provided by Oracle for VRDP remote desktop support, RDP data can optionally be encrypted. See RDP Encryption. Only the Enhanced RDP Security method (RDP5.2) with TLS protocol provides a secure connection. Standard RDP Security (RDP4 and RDP5.1) is vulnerable to a man-in-the-middle attack.
- When using the Oracle VM VirtualBox Extension Pack provided by Oracle for disk encryption, the data stored in disk images can optionally be encrypted. See Encryption of Disk Images. This feature covers disk image content only. All other data for a virtual machine is stored unencrypted, including the VM's memory and device state which is stored as part of a saved state, both when created explicitly or part of a snapshot of a running VM.

Security Recommendations

This section contains security recommendations for specific issues. By default VirtualBox will configure the VMs to run in a secure manner, however this may not always be possible without additional user actions such as host OS or firmware configuration changes.

CVE-2018-3646

This security issue affect a range of Intel CPUs with nested paging. AMD CPUs are expected not to be impacted (pending direct confirmation by AMD). Also the issue does not affect VMs running with hardware virtualization disabled or with nested paging disabled.

For more information about nested paging, see Nested Paging and VPIDs.

The following mitigation options are available.

Disable Nested Paging

By disabling nested paging (EPT), the VMM will construct page tables shadowing the ones in the guest. It is no possible for the guest to insert anything fishy into the page tables, since the VMM carefully validates each entry before shadowing it.

As a side effect of disabling nested paging, several CPU features will not be made available to the guest. Among these features are AVX, AVX2, XSAVE, AESNI, and POPCNT. Not all guests may be able to cope with dropping these features after installation. Also, for some guests, especially in SMP configurations, there could be stability issues arising from disabling nested paging. Finally, some workloads may experience a performance degradation.

Flushing the Level 1 Data Cache

This aims at removing potentially sensitive data from the level 1 data cache when running guest code. However, it is made difficult by hyper-threading setups sharing the level 1 cache and thereby potentially letting the other thread in a pair refill the cache with data the user does not want the guest to see. In addition, flushing the level 1 data cache is usually not without performance side effects.

Up to date CPU microcode is a prerequisite for the cache flushing mitigations. Some host OSes may install these automatically, though it has traditionally been a task best performed by the system firmware. So, please check with your system / mainboard manufacturer for the latest firmware update.

We recommend disabling hyper threading on the host. This is traditionally done from the firmware setup, but some OSes also offers ways disable HT. In some cases it may be disabled by default, but please verify as the effectiveness of the mitigation depends on it.

The default action taken by VirtualBox is to flush the level 1 data cache when a thread is scheduled to execute guest code, rather than on each VM entry. This reduces the performance impact, while making the assumption that the host OS will not handle security sensitive data from interrupt handlers and similar without taking precautions.

A more aggressive flushing option is provided via the `VBoxManage modifyvm --l1d-flush-on-vm-entry` option. When enabled the level 1 data cache will be flushed on every VM entry. The performance impact is greater than with the default option, though this of course depends on the workload. Workloads producing a lot of VM exits (like networking, VGA access, and similiar) will probably be most impacted.

For users not concerned by this security issue, the default mitigation can be disabled using the `VBoxManage modifyvm` *`name`* `--l1d-flush-on-sched off` command.

CVE-2018-12126, CVE-2018-12127, CVE-2018-12130, CVE-2019-11091

These security issues affect a range of Intel CPUs starting with Nehalem. The CVE-2018-12130 also affects some Atom Silvermont, Atom Airmont, and Knights family CPUs, however the scope is so limited that the host OS should deal with it and Oracle VM VirtualBox is therefore not affected. Leaks only happens when entering and leaving C states.

The following mitigation option is available.

Buffer Overwriting and Disabling Hyper-Threading

First, up to date CPU microcode is a prerequisite for the buffer overwriting (clearing) mitigations. Some host OSes may install these automatically, though it has traditionally been a task best performed by the system firmware. Please check with your system or mainboard manufacturer for the latest firmware update.

This mitigation aims at removing potentially sensitive data from the affected buffers before running guest code. Since this means additional work each time the guest is scheduled, there might be some performance side effects.

We recommend disabling hyper-threading (HT) on hosts affected by CVE-2018-12126 and CVE-2018-12127, because the affected sets of buffers are normally shared between thread pairs and therefore cause leaks between the threads. This is traditionally done from the firmware setup, but some OSes also offers ways disable HT. In some cases it may be disabled by default, but please verify as the effectiveness of the mitigation depends on it.

The default action taken by Oracle VM VirtualBox is to clear the affected buffers when a thread is scheduled to execute guest code, rather than on each VM entry. This reduces the performance impact, while making the assumption that the host OS will not handle security sensitive data from interrupt handlers and similar without taking precautions.

The `VBoxManage modifyvm` command provides a more aggressive flushing option is provided by means of the `--mds-clear-on-vm-entry` option. When enabled the affected buffers will be cleared on every VM entry. The performance impact is greater than with the default option, though this of course depends on the workload. Workloads producing a lot of VM exits (like networking, VGA access, and similiar) will probably be most impacted.

For users not concerned by this security issue, the default mitigation can be disabled using the `VBoxManage modifyvm name --mds-clear-on-sched off` command.

14

Known Limitations

Experimental Features

Some Oracle VM VirtualBox features are labeled as experimental. Such features are provided on an "as-is" basis and are not formally supported. However, feedback and suggestions about such features are welcome. A comprehensive list of experimental features is as follows:

- Hardware 3D acceleration support for Windows, Linux, and Oracle Solaris guests
- Hardware 2D video playback acceleration support for Windows guests
- Mac OS X guests (macOS hosts only)
- ICH9 chipset emulation
- EFI firmware
- Host CD/DVD drive passthrough
- Support of iSCSI using internal networking
- Using Oracle VM VirtualBox and Hyper-V on the same host

Known Issues

The following section describes known problems with this release of Oracle VM VirtualBox. Unless marked otherwise, these issues are planned to be fixed in later releases.

- The macOS installer packages for Oracle VM VirtualBox 7 currently do not include the Internal Networking feature, which is available on all other platforms. This will be addressed with an update of Oracle VM VirtualBox 7. For setups which depend on this functionality it is best to keep using Oracle VM VirtualBox 6.1.
- Poor performance when using Oracle VM VirtualBox and **Hyper-V** on the same host. To fix this, certain Windows features like "Hyper-V Platform", "Virtual Machine Platform" and "Windows Hypervisor Platform" must be turned off, followed by a host reboot.

  Additionally, the Microsoft Device Guard and Credential Guard hardware readiness tool might have to be used in order to turn off more features. For example, by running the following command:

  ```
  .\DG_Readiness_Tool_vX.X.ps1 -Disable -AutoReboot
  ```

  > **Note:**
  >
  > Disabling Device Guard and Credential Guard features will have an impact on the overall security of the host. Please contact your Administrator beforehand regarding this.

- The following **Guest SMP (multiprocessor) limitations** exist:

  - **Poor performance** with 32-bit guests on AMD CPUs. This affects mainly Windows and Oracle Solaris guests, but possibly also some Linux kernel revisions. Partially solved for 32-bit Windows NT, 2000, XP, and 2003 guests. Requires the Guest Additions to be installed.
  - **Poor performance** with 32-bit guests on certain Intel CPU models that do not include virtual APIC hardware optimization support. This affects mainly Windows and Oracle Solaris guests, but possibly also some Linux kernel revisions. Partially solved for 32-bit Windows NT, 2000, XP, and 2003 guests. Requires the Guest Additions to be installed.

- **NX (no execute, data execution prevention)** only works for guests running on 64-bit hosts and requires that hardware virtualization be enabled.
- **Guest control.** On Windows guests, a process started using the guest control execute support will not be able to display a graphical user interface *unless* the user account under which it is running is currently logged in and has a desktop session.

  Also, to use accounts without or with an empty password, the guest's group policy must be changed. To do so, open the group policy editor on the command line by typing `gpedit.msc`, open the key `Computer Configuration\Windows Settings\Security Settings\Local Policies\Security Options` and change the value of `Accounts: Limit local account use of blank passwords to console logon only` to Disabled.
- **Compacting virtual disk images is limited to VDI files.** The `VBoxManage modifymedium --compact` command is currently only implemented for VDI files. At the moment the only way to optimize the size of a virtual disk images in other formats, such as VMDK or VHD, is to clone the image and then use the cloned image in the VM configuration.
- **OVF import/export:**
  - OVF localization, with multiple languages in a single OVF file, is not yet supported.
  - Some OVF sections like StartupSection, DeploymentOptionSection, and InstallSection are ignored.
  - OVF environment documents, including their property sections and appliance configuration with ISO images, are not yet supported.
  - Remote files using HTTP or other mechanisms are not yet supported.
- Neither **scale mode** nor **seamless mode** work correctly with guests using OpenGL 3D features, such as with Compiz-enabled window managers.
- The RDP server in the Oracle VM VirtualBox extension pack supports only audio streams in format 22.05kHz stereo 16-bit. If the RDP client requests any other audio format there will be no audio.
- Preserving the aspect ratio in scale mode works only on Windows hosts and on macOS hosts.
- On **macOS hosts**, the following features are not yet implemented:
  - Numlock emulation
  - CPU frequency metric
  - Memory ballooning
- **macOS/ARM64 (Apple silicon) host package**
- **Mac OS X guests:**
  - Mac OS X guests can only run on a certain host hardware. For details about license and host hardware limitations. See Mac OS X Guests and check the Apple software license conditions.

  - Oracle VM VirtualBox does not provide Guest Additions for Mac OS X at this time.
  - The graphics resolution currently defaults to 1024x768 as Mac OS X falls back to the built-in EFI display support. See Video Modes in EFI for more information on how to change EFI video modes.
  - Mac OS X guests only work with one CPU assigned to the VM. Support for SMP will be provided in a future release.
  - Depending on your system and version of Mac OS X, you might experience guest hangs after some time. This can be fixed by turning off energy saving. Set the timeout to "Never" in the system preferences.
  - By default, the Oracle VM VirtualBox EFI enables debug output of the Mac OS X kernel to help you diagnose boot problems. Note that there is a lot of output and not all errors are fatal. They would also show when using a physical Apple Macintosh computer. You can turn off these messages by using the following command:

    ```
    $ VBoxManage setextradata VM-name "VBoxInternal2/EfiBootArgs" "  "
    ```

    To revert to the previous behavior, use the following command:

    ```
    $ VBoxManage setextradata VM-name "VBoxInternal2/EfiBootArgs" ""
    ```

  - It is currently not possible to start a Mac OS X guest in safe mode by specifying the `-x` option in `VBoxInternal2/EfiBootArgs` extradata.

- **Oracle Solaris hosts:**
  - USB support on Oracle Solaris hosts requires Oracle Solaris 11 version snv_124 or later. Webcams and other isochronous devices are known to have poor performance.
  - Host Webcam passthrough is restricted to 640x480 frames at 20 frames per second due to limitations in the Oracle Solaris V4L2 API. This may be addressed in a future Oracle Solaris release.
  - No ACPI information, such as battery status or power source, is reported to the guest.
  - No support for using wireless adapters with bridged networking.
  - Crossbow-based bridged networking on Oracle Solaris 11 hosts does not work directly with aggregate links. However, you can use `dladm` to manually create a VNIC over the aggregate link and use that with a VM. This limitation does not exist in Oracle Solaris 11u1 build 17 and later.
- Neither virtio nor Intel PRO/1000 drivers for **Windows XP guests** support segmentation offloading. Therefore Windows XP guests have slower transmission rates comparing to other guest types. Refer to MS Knowledge base article 842264 for additional information.
- **Guest Additions for OS/2.** Seamless windows and automatic guest resizing will probably never be implemented due to inherent limitations of the OS/2 graphics system.
- Some guest operating systems predating ATAPI CD-ROMs may exhibit long delays or entirely fail to boot in certain configurations. This is most likely to happen when an IDE/ATAPI CD-ROM exists alone on a primary or secondary IDE channel.

  Affected operating systems are MS OS/2 1.21: fails to boot with an error message referencing COUNTRY.SYS and MS OS/2 1.3: long boot delays. To avoid such problems, disable the emulated IDE/ATAPI CD-ROM. The guest OS cannot use this device, anyway.

15

Oracle VM VirtualBox Privacy Information

Version 5, Dec 13, 2012

The Oracle Privacy Policies posted on https://www.oracle.com/legal/privacy/privacy-policy.html apply to your personal data collected and used by Oracle. The following privacy information describes in more detail which information is exchanged between the Oracle VM VirtualBox application and Oracle, and which information is collected by the virtualbox.org website.

§ 1 virtualbox.org. The "virtualbox.org" website logs anonymous usage information such as your IP address, geographical location, browser type, referral source, length of visit and number of page views while you visit (collectively, "anonymous data"). In addition, but only if you choose to register, the website's bug tracking and forum services store the data you choose to reveal upon registration, such as your user name and contact information.

§ 2 Cookies. The virtualbox.org website, the bug tracker and the forum services use cookies to identify and track the visiting web browser and, if you have registered, to facilitate login. Most browsers allow you to refuse to accept cookies. While you can still visit the website with cookies disabled, logging into the bug tracker and forum services will most likely not work without them.

§ 3 Oracle VM VirtualBox registration process. The Oracle VM VirtualBox application may ask that the user optionally register with Oracle. If you choose to register, your name, e-mail address, country and company will be submitted to Oracle and stored together with the IP address of the submitter as well as product version and platform being used.

§ 4 Update notifications. The Oracle VM VirtualBox application may contact Oracle to find out whether a new version of Oracle VM VirtualBox has been released and notify the user if that is the case. In the process, anonymous data such as your IP address and a non-identifying counter, together with the product version and the platform being used, is sent so that the server can find out whether an update is available. By default, this check is performed once a day. You change this interval or disable these checks altogether in the Oracle VM VirtualBox preferences.

§ 5 Usage of personal information. Oracle may use anonymous and personal data collected by the means above for statistical purposes as well as to automatically inform you about new notices related to your posts on the bug tracker and forum services, to administer the website and to contact you due to technical issues. Oracle may also inform you about new product releases related to Oracle VM VirtualBox.

In no event will personal data without your express consent be provided to any third parties, unless Oracle may be required to do so by law or in connection with legal proceedings.

§ 6 Updates. Oracle may update the privacy policy at any time by posting a new version at https://www.oracle.com/legal/privacy/privacy-policy.html and the privacy information will be kept up to date in the documentation which comes with the Oracle VM VirtualBox application. You should check these places occasionally to ensure you are happy with any changes.

16 Glossary

This chapter describes some terms and abbreviations used in this document.

ACPI

Advanced Configuration and Power Interface, an industry specification for BIOS and hardware extensions to configure PC hardware and perform power management. Windows 2000 and later, as well as Linux 2.4 and later support ACPI. Windows can only enable or disable ACPI support at installation time.

AHCI

Advanced Host Controller Interface, the interface that supports SATA devices such as hard disks. See Hard Disk Controllers.

AMD-V

The hardware virtualization features built into modern AMD processors. See Hardware Virtualization.

API

Application Programming Interface.

APIC

Advanced Programmable Interrupt Controller, a newer version of the original PC PIC (programmable interrupt controller). Most modern CPUs contain an on-chip APIC, called a local APIC. Many systems also contain an I/O APIC (input output APIC) as a separate chip which provides more than 16 IRQs. Windows 2000 and later use a different kernel if they detect an I/O APIC during installation. Therefore, an I/O APIC must not be removed after installation.

ATA

Advanced Technology Attachment, an industry standard for hard disk interfaces which is synonymous with IDE. See Hard Disk Controllers.

BIOS

Basic Input/Output System, the firmware built into most personal computers which is responsible of initializing the hardware after the computer has been turned on and then booting an operating system. Oracle VM VirtualBox ships with its own virtual BIOS that runs when a virtual machine is started.

COM

Microsoft Component Object Model, a programming infrastructure for modular software. COM enables applications to provide application programming interfaces which can be accessed from various other programming languages and applications. Oracle VM VirtualBox makes use of COM both internally and externally to provide a comprehensive API to third party developers.

DHCP

Dynamic Host Configuration Protocol. This enables a networking device in a network to acquire its IP address and other networking details automatically, in order to avoid having to configure all devices in a network with fixed IP addresses. Oracle VM VirtualBox has a built-in DHCP server that delivers an IP addresses to a virtual machine when networking is configured to NAT. See Virtual Networking.

EFI

Extensible Firmware Interface, a firmware built into computers which is designed to replace the aging BIOS. Originally designed by Intel, most modern operating systems can now boot on computers which have EFI instead of a BIOS built into them. See Alternative Firmware (EFI).

EHCI

Enhanced Host Controller Interface, the interface that implements the USB 2.0 standard.

GUI

Graphical User Interface. Commonly used as an antonym to a "command line interface". In the context of Oracle VM VirtualBox, we sometimes refer to the main graphical VirtualBox program as the "GUI", to differentiate it from the VBoxManage interface.

GUID

See UUID.

GUI

See APIC.

IDE

Integrated Drive Electronics, an industry standard for hard disk interfaces. See Hard Disk Controllers.

iSCSI

Internet SCSI. See iSCSI Servers

MAC

Media Access Control, a part of an Ethernet network card. A MAC address is a 6-byte number which identifies a network card. It is typically written in hexadecimal notation where the bytes are separated by colons, such as `00:17:3A:5E:CB:08`.

MSI

Message Signaled Interrupts, as supported by modern chipsets such as the ICH9. See Motherboard Tab. As opposed to traditional pin-based interrupts, with MSI, a small amount of data can accompany the actual interrupt message. This reduces the amount of hardware pins required and allows for more interrupts and better performance.

NAT

Network Address Translation. A technique to share networking interfaces by which an interface modifies the source and/or target IP addresses of network packets according to specific rules. Commonly employed by routers and firewalls to shield an internal network from the Internet, Oracle VM VirtualBox can use NAT to easily share a host's physical networking hardware with its virtual machines. See Network Address Translation (NAT).

OVF

Open Virtualization Format, a cross-platform industry standard to exchange virtual appliances between virtualization products. See Importing and Exporting Virtual Machines.

PAE

Physical Address Extension. This enables access to more than 4 GB of RAM, even in 32-bit environments. See Advanced Tab.

PIC

See APIC.

PXE

Preboot Execution Environment, an industry standard for booting PC systems from remote network locations. It includes DHCP for IP configuration and TFTP for file transfer. Using UNDI, a hardware independent driver stack for accessing the network card from bootstrap code is available.

RDP

Remote Desktop Protocol, a protocol developed by Microsoft as an extension to the ITU T.128 and T.124 video conferencing protocol. With RDP, a PC system can be controlled from a remote location using a network connection over which data is transferred in both directions. Typically graphics updates and audio are sent from the remote machine and keyboard and mouse input events are sent from the client. An Oracle VM VirtualBox extension package by

Oracle provides VRDP, an enhanced implementation of the relevant standards which is largely compatible with Microsoft's RDP implementation. See Remote Display (VRDP Support) for details.

SAS

Serial Attached SCSI, an industry standard for hard disk interfaces. See Hard Disk Controllers.

SATA

Serial ATA, an industry standard for hard disk interfaces. See Hard Disk Controllers.

SCSI

Small Computer System Interface. An industry standard for data transfer between devices, especially for storage. See Hard Disk Controllers.

SMP

Symmetrical Multiprocessing, meaning that the resources of a computer are shared between several processors. These can either be several processor chips or, as is more common with modern hardware, multiple CPU cores in one processor.

SSD

Solid-state drive, uses microchips for storing data in a computer system. Compared to classical hard-disks they have no mechanical components, such as spinning disks.

TAR

A widely used file format for archiving. Originally, this stood for Tape ARchive and was already supported by very early UNIX versions for backing up data on tape. The file format is still widely used today. For example, with OVF archives using an `.ova` file extension. See Importing and Exporting Virtual Machines.

UUID

A Universally Unique Identifier, often also called GUID (Globally Unique Identifier). A UUID is a string of numbers and letters which can be computed dynamically and is guaranteed to be unique. Generally, it is used as a global handle to identify entities. Oracle VM VirtualBox makes use of UUIDs to identify VMs, Virtual Disk Images (VDI files), and other entities.

VM

Virtual Machine. A virtual computer that Oracle VM VirtualBox enables you to run on top of your actual hardware. See Some Terminology for details.

VMM

Virtual Machine Manager. The component of Oracle VM VirtualBox that controls VM execution. See Oracle VM VirtualBox Executables and Components for a list of Oracle VM VirtualBox components.

VRDE

VirtualBox Remote Desktop Extension. This interface is built into Oracle VM VirtualBox to allow Oracle VM VirtualBox extension packages to supply remote access to virtual machines. An Oracle VM VirtualBox extension package by Oracle provides VRDP support. See Remote Display (VRDP Support).

VRDP

See RDP.

VT-x

The hardware virtualization features built into modern Intel processors. See Hardware Virtualization.

xHCI

eXtended Host Controller Interface. The interface that implements the USB 3.0 standard.

XML

The eXtensible Markup Language, a metastandard for all kinds of textual information. XML only specifies how data in the document is organized generally and does not prescribe how to semantically organize content.

XPCOM

Mozilla Cross Platform Component Object Model, a programming infrastructure developed by the Mozilla browser project which is similar to Microsoft COM and enables applications to provide a modular programming interface. Oracle VM VirtualBox makes use of XPCOM on Linux both internally and externally to provide a comprehensive API to third-party developers.